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Edge cities characterized by high wage office based industries are of particular interest to planners since they reflect the type of development often associated with economic growth in the suburban landscape, but not well understood as shown by the debate over edge and edgeless cities. Very little research has been conducted that looks specifically to address whether Garreau's edge cities of the 90's have improved upon the concerns raised by critics in an effort to further replicate a traditional historical Central Business District (CBD) and sustain future growth or whether suburban landscapes have continued to resemble the edge city pattern at all. Very specifically, this thesis examines the following questions: (1) Can the combination of employment and population data be used to differentiate between edge and edgeless developments? (2) To what extent have edge cities of the 90's adapted to further replicate traditional historical urban employment centers and to sustain future growth? (3) Have suburban landscapes continued to resemble the edge city, edgeless city or office sprawl pattern? (4) Can the existence and use of alternative/active transportation influence the development of edge cities? (5) Will edge cities of suburban Atlanta continue to develop relying on implementation of smart urbanism concepts and alternative transportation options? This research aimed at determining accurate geographic locations and boundaries of edge cities in the Atlanta MSA, using employment densities and characteristics, is able to precisely differentiate between areas that fit into the typology of edge cities, urban and suburban employment centers. It is clear from these findings that edge cities have yet to become the "crucible"

of urban America, as Garreau advocated. What is certain is that edge cities are part of a dynamic process that parallels that of the more traditional urban core. The regard for alternative development patterns has diminished in light of recent economic and environmental trends, shown by efforts to "revitalize" existing urban landscapes and strengthen public transportation. This outlook represents a principle theme that is interwoven into this research as it applies to the sustainability of future edge city growth. The research concludes with benchmarks of measurement with the intention of providing a universal understanding as to the where and why of edge city developments in particular.

Keywords: Edge cities, Edgeless cities, Employment centers, Atlanta

EDGE CITIES REVISITED: THE RESTLESS SUBURBAN LANDSCAPE

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CHAPTER I

INTRODUCTION

In the early 90's, author Joel Garreau, took notice of the way in which suburban landscapes were developing and coined the term "edge city" to describe the phenomenon of large scale employment concentrations outside of the more traditional central city business district (Garreau 1991). Edge cities with high rise office parks and adjacent retail districts represented a distinctive lifestyle for suburban residents who would otherwise normally have driven into the city for employment and shopping (Anderson and Bogart 2001, Beauregard 1995, Sultana 2011). In his initial reaction, Garreau states that edge cities are going to be places that will experience the most population growth in the future due to their offering benefits and conveniences of dense urban areas at a much closer location to popular suburban residential neighborhoods.

Criticism of Garreau's idea developed from not only the lack of consistency in his definition of edge cities and their existence, but also from the lack of a growing awareness of and current trends concerning aspects of density and urban living that are missing from edge cities (Lang 2003, Bingham 1997, Weitz 2003). People living in traditional city centers today have benefits such as diverse housing, employment and

transportation options, pedestrian friendly and mixed use developments, often as a result of efficiency and sustainable neighborhood and community plans that incorporate public space (Scheer and Petkov 1998, Kunstler 1993), and hence edge cities were challenged for the benefits that traditional cities could offer. Very little research has been conducted that specifically addresses whether Garreau's edge cities of the 90's have adapted to the apprehensions raised by critics in an effort to further replicate a traditional historical Central Business District (CBD) and sustain future growth or whether suburban landscapes have continued to resemble the edge city pattern at all.

Many of the short falls in edge cities are due to the shift in cultural perceptions of environmental issues from the development of low density outward "sprawl" type growth patterns to growing awareness of smart growth and new urbanism development concepts. In planning practices, these smart urbanism concepts aim to limit outward expansion of cities by preserving open space and promoting density, diversity, transportation options, and job housing balance (Wheeler 2004). For example, while Garreau (1991) acknowledges that edge cities are conveniently located along expressway and freeway corridors allowing for easy access to the employment and shopping centers, today this draws criticism due to the reliance on auto based modes of transportation during a time when people are looking to offset energy prices and environmental hazards through alternative modes of transportation.

Additional issues of debate concerning edge cities stem from Garreau's vague criteria used to define what and where edge cities are. Garreau states edge cities have

more jobs than houses, emphasizing a jobs-housing imbalance issue when current policy is more in favor of a job-housing balance for future urban growth (Cervero 1996, Sultana 2002). Additionally, Garreau states that edge cities often cross a variety of political boundaries with no direct oversight of development, drawing attention to the lack of identifiable boundaries for implementing development initiatives. At the core of what defines an edge city is the concentrated, high density, specialized "white collar" employment. The perception that the workforce of edge cities is very homogeneous in terms of income, race and ethnicity perpetuates ideas that edge cities disproportionately disadvantage some groups (Garreau 1991, Weitz 2003, Beauregard 1995).

In addition, very recently, Robert E. Lang challenged Garreau's idea that claimed edge cities will be the development model for future America. In direct opposition to Garreau, Lang (2003) insists that the predominant suburban employment trend resembles a small scale and scattered form of commercial development, more spread out and lacking the large scale highly concentrated employment centers found in edge cities. His book entitled "Edgeless Cities" points out the vague and varied definitions that are commonly used to define peripheral metropolitan regions based on office space, stating that "edgeless cities are not easy to map" (Lang 2003). Using Garreau's (1991) office and retail space square footage methodology, Lang insists that more than two-thirds of all non-downtown office space, nearly double the office space in edge cities, is spread out and should be categorized as "edgeless" rather than Garreau's claim of defined concentrated office space nodes as edge cities. The widely acknowledged "Edge City"

and “Edgeless City” developmental patterns exhibit a lack of understanding in the ongoing debate of suburban growth trends.

To address edge cities criticisms and concerns accredited to continued low density suburban development compared to the traditional urban settings, this thesis will investigate how the location of employment centers and edge cities in particular have changed to meet the needs of expanding employment and housing pressures from 1990 to 2000. To gain a better understanding of the current movement towards smart urbanism and how it could influence suburban developments, this paper will examine measurements of density, population and transportation diversity, and the jobs-to-housing ratio that exist in employment centers vs. edge cities. While this approach can be applicable to the study of edge cities in any Metropolitan Statistical Area (MSA) in the US, this particular study focuses on the Atlanta, Georgia MSA. Very specifically, this thesis will examine the following questions: (1) Can the combination of employment and population data be used to differentiate between edge and edgeless developments? (2) To what extent have edge cities of the 90’s adapted to further replicate traditional historical urban employment centers and to sustain future growth? (3) Have suburban landscapes continued to resemble the edge city, edgeless city or office sprawl pattern? (4) Can the existence and use of alternative/active transportation influence the development of edge cities? (5) Will edge cities of suburban Atlanta continue to develop relying on implementation of smart urbanism concepts and alternative transportation options?

The above questions are still not addressed due to Garreau's (1991) vague definition of edge cities and their existence. This thesis will address many criticisms that have not been previously examined with a methodologically sound approach. To do so, a modified new systematic method for identifying edge cities and employment centers will be used. The new methodology will lay the groundwork for the rest of the research in this study, as well as develop a standard practice to be used in future edge city research. This new method based on identifying employment centers, used initially by Giuliano and Small (1991) to study Los Angeles is based on density, total numbers of jobs and contiguity. This approach later was modified by Sultana (2000) to create a more appropriate application to the total population of Atlanta as compared to Los Angeles at the transportation analysis zone (TAZ) level. In addition to that, using the location quotient to highlight the locations of office and retail based industries in particular, parallels the measurement of office space concentration that Garreau (1991) originally used to identify edge cities in his book. The Census Transportation Planning Package (CTPP) data will address the socioeconomic makeup of edge cities and employment centers. Data from two years, 1990 and 2000 is used to explore trends in suburban development and the influence of transportation infrastructure on suburban population patterns.

By developing a new method of classifying suburban and urban regions based on employment, the findings in this study will present a number of opportunities and challenges for planners, developers and future researchers. The economic potential of the urban periphery is not well understood, as is shown by the debate over edge and edgeless

cities (Garreau 1991, Lang 2003). Through review of past work, a common theme of sustainable developments is that increasing density by providing more amenities in a smaller space effectively discourages new outward growth (Wheeler 2004). The method used to categorize the suburban landscape in this research is built around the measurement of employment density and how it relates to the socioeconomic and demographic makeup of employment centers. Benefits of density associated with the smart urbanism trend could be characteristic of the edge cities in this research. This study will contribute to the important and ongoing struggle to efficiently manage growing population and employment. The future growth of edge cities will rely on their ability to adapt to current trends. Whether edge cities of the 90's have remained economically active and if new edge cities can sustain future growth has not been directly addressed in past research. In an effort to provide a geographical perspective to the faults in edge and edgeless city principles, this thesis will approach suburban employment patterns focusing on new land use typologies.

CHAPTER II

REVIEW OF LITERATURE

2.1 Definition of Edge Cities

While edge cities are newcomers relative to the history of attempts at sustainable urban growth management, earlier attempts at garden cities (Howard 1898), urban villages (Jacobs 1961) and satellite towns represented a similar trend in job location. According to Garreau, edge cities should:

- Have five million square feet or more of leasable office space
- Have six hundred thousand square feet or more of leasable retail space
- Have more jobs than bedrooms
- Be Perceived by the population as one place
- Be Nothing like a city as recently as 30 years ago

Garreau's criteria for what determines an edge city emphasizes that these places function primarily as commercial centers in the effort to replicate a traditional city, hence the name edge city. Garreau incorporates nothing about the physical typologies of traditional urban cores into edge cites, including transportation and housing characteristics making it difficult to draw similarities between the two. Edge cities are aptly named after their distinctive location near the urban fringe (Lang 2003). Unfortunately, edge cities lack formal jurisdictional boundaries, making them difficult to identify and manage.

Garreau does provide some more detailed insight into the types of edge cities by classifying them as, Uptowns, Boomburbs or Greenfields (Garreau 1991). Uptowns are places formed out of the growth or revival of older suburban centers. Boomburbs are new centers of growth within areas of urban sprawl, usually surrounding a growth pole such as a mall. Greenfields are new planned communities, where a professional planning effort is in control of all residential and economic form (Sheer and Petkov 1998). In either case, the development of new commercial land use is driven by private market developers that demonstrate auto-orientated suburban models (Southworth 1997).

Academic work exploring the phenomenon of edge cities and their development highlight their strategic locations and the resulting impacts of surrounding regions (Henderson and Mitra, 1996). A common theme among the economic geography of edge city developments is the issue of vacated business districts in the urban core as a result of edge cites drawing employers and employees into the periphery. The economic driver of edge city locations is based on a model of inputs that determines where an industry will have the greatest source of cheap land, labor and little competition. Locations are strategically predicted by private developers considering the economic activities of firms and behavior of households (Sultana 2011). With this type of research, however, the identification of edge city locations raises more questions than answers concerning the extent of their functions (McKee 2001).

The importance of combining housing with jobs and shopping opportunities in one location was the primary focus behind edge city developments. Little thought was

given towards integrating sustainable growth management practices in edge city developments of the 90's.

2.2 Criticisms of Edge Cities

Critics scrutinize edge cities for a variety of reasons, including the lack of geographically definable boundaries (Lang 2003), an imbalance between the number of people working and the availability of housing for the employees of edge cities (Weitz 2003)and the lack of diversity in terms of race, income, and housing options (Beauregard 1995). More recently, criticism of the car dependent infrastructure and lack of alternative and pedestrian friendly transportation options (Sultana, 2011) has brought negative opinions of edge cities and suburban developments in general.

2.2.1 Boundary Issues

Because no significant standard for spatial boundaries has yet been determined for edge cities, some critics argue that the term edge city is a misrepresentation of the suburban development pattern it defines (Lang 2003). A common understanding of edge cities that highlights the lack of progressive management is the fact that they rarely fall under one identifiable jurisdiction, political boundary, or governmental unit. This discrepancy is magnified by the fact that while people work, shop and consume in edge cities, rarely do they identify themselves as "citizens" of them. In many cases, edge cities are established alongside large-scale private residential developments having their own shadow governments prohibiting interactions across boundaries of race and income (Beauregard 1995). Creating a simple replicable method for delineating edge city boundaries is extremely important since the edge cities of the 90's lack geographical

confines that incorporate residential numbers and indicate a potential for continued urban sprawl complicating the task of growth management and control (Platt 2004). The potential for edge cities to accommodate a moderate amount of expansion, while not sprawling into edgeless developments, is a valid concern in this research. Ultimately, the lack of regional cooperation among municipal governments perpetuates impractical land use developments in edge cities, as well as suburban regions in general, resulting in boundless growth (Lang 2003). This thesis will ignore existing jurisdictional boundaries that may intersect the identified edge cities. Instead, the use of Google Maps will determine place names for identified edge cites. In addition to identifying edge cities using 1990 and 2000 year data, the average size in acreage of edge cities for the two years will be explored, addressing the growth and expansion of edge city development in the Atlanta region.

The most commonly used method of edge city identification in previous research is to use measurements of office space square footage to identify edge cities (Bingham 1997, Lang 2003). Since government agencies do not collect office market statistics, real estate and consulting firms like "Blacks Guide" offer documented data for leasable buildings describing the square feet available on a building by building basis. A variety of other such companies provide similar data; however, there are no uniform guidelines for determining basic office market attributes such as total size (Lang 2003). Data from Blacks Guide is aggregated by 5 digit zip code at its most detailed level. The process required to geo-locate each office building using its street address, then compile the total

square feet of office space in each could result in inaccurate measurements of both location and office space type.

One problem with the office space method, as well as Garreau's criteria, is that no consideration is given to the actual population that is required to supply the workforce of an edge city (Lang 2003). Edge city research that utilizes office space, often fails to acknowledge residential zones neighboring large office parks. Naturally, such research falls short of describing the relationship between employee and occupation concentrations found in edge city markets. Solving the spatial puzzle between the location of employees and the location of occupations is a key goal in the planning of urban landscapes (Platt 2004). Additionally, measurements of office space square footage in past research have been limited to predefined city boundaries, thus creating inconsistent results since edge cities are indifferent to jurisdictional boundaries (Lang 2003). For these reasons, this thesis intends to develop criteria to identify edge cities that will allow the study of these elusive places in a more systematic manner.

2.2.2 Edge Cities Through a Smart Urbanism Lens

New urbanism and smart growth concepts have been welcomed into the fields of urban planning for their focus on reducing sprawl and decreasing reliance on the automobile through creation of diverse housing options and transportation oriented developments (Wheeler 2004). Reducing commuting times by having multiple amenities in one location is an idea behind edge cities that resembles current attempts at smart urbanism.

While new urbanism and smart growth are relatively new practices, considered only to be theory by some, they provide alternatives and solutions to the many criticisms of edge cities. Smart growth and new urbanism are two similar efforts that aim to develop more livable communities. Through high density, walkable neighborhoods, mixed use, balanced transportation alternatives and economic and racial heterogeneity, smart urbanism can create less traffic congestion, vibrant cities, and a wide variety of housing types (Wheeler 2004, Smart Growth America). Garreau's edge city of the 90's demonstrated the simple idea of maximizing the economic efficiency of the suburban landscape (Garreau 1991). At that time, suburban land developers practiced few restrictions in the way new communities were built, resulting in city-like nodes consisting of neighborhoods in function only (Southworth 1997). Very few of the physical elements present in traditional downtowns were incorporated into the development of edge cities. Sustainable infrastructure concepts, including diversity in housing types, public transportation options and transportation oriented developments, were overlooked in favor of commercial infrastructure that emphasized office and retail space with ample parking. One of the unfounded principles that developers adhere to is the idea that "No American will walk more than six hundred feet before entering his or her car" (Garreau 1991). Increased awareness of the environment is an issue that spurs investigation into what makes traditional cities more sustainable than edge cities. Research involving measurements of features and the benefits of efficiency associated with cities transformed the perception of urban areas (Wheeler 2004, Kunstler 1993).

Using measurements of vehicles per capita, population and housing density, applications of smart urbanism can be examined in edge cities. Facilitation of smart growth principles in edge cities might be limited by the available housing options and existing transportation networks, allowing the potential threat of excessive outward sprawl (Ding and Bingham 2000). For example, the office space cluster in Tysons Corner began expanding its residential capacity as a result of the inability to effectively manage population growth and traffic congestion (Swope 2009). However, Tysons Corner, a well-known edge city, is beginning to transition to a "better" suburb. Combining dense high rise living options with mixed use as infill around the new planned metro rail stations are ways the edge city is adapting to the needs of today's suburban population (Swope 2009). The long range plan for this area also includes grafting a traditional street grid onto the landscape of existing blocks to attract more diverse housing options (Swope 2009).

Public transportation options, increased density and diversity in terms of employment and housing, if applied adequately, could change the criticized view of edge cities. This paper examines the use of alternative and active transportation among employees and residents, the diversity of incomes, and housing availability, as well as population and housing density of edge cities in Atlanta. The evaluation of these variables and their relation to smart urbanism will be the primary indicators of smart urbanism practices in edge cities. While these measures alone do not constitute the existence of smart growth or new urbanism practices, they can suggest that such practices are in use or being developed.

2.2.3 Jobs-Housing Balance and Mismatch

Encouraging development where jobs, houses and services are located close to one another is the motivation of a jobs-housing balance (Ma and Banister 2006). The jobs-housing balance is a necessary condition for moving towards sustainable urban development, by providing employment opportunities that match labor force skill levels, thus minimizing commuting times (Sultana 2002). Edge cities, however, by their own definition develop a series of imbalances between residents and the economic infrastructure (Weitz 2003). In a report by the American Planning Association, the job-housing balance created in edge cities is explored and criticized. Early edge cities represent a transitioning job-housing balance, existing first as bedroom communities with an abundance of high-end housing and not enough high wage employment. Employers eager to locate closer to pools of skilled labor failed to develop sufficient affordable housing for service related industries that followed the surge of office space based construction in bedroom communities (Weitz 2003). When various levels of employment opportunities began to cluster in edge cities, the resulting mix of economic activities surrounded by the pre-existing high-end housing developed a "jobs rich" job-housing imbalance, in addition to traffic disparities for low wage employees. The more jobs than bedrooms criteria within Garreau's definition of edge cities, deters potential sustainable growth management applications (PAS Report #516 2003, pg.7-8).

For this thesis, use of the simple jobs to housing ratio as a measurement of the job-housing balance in edge cities will be used in conjunction with commuting time measurements often cited as indicators of a job-housing balance. Because past research

shows that the simple ratio of total jobs to total available housing is not an adequate indicator (Sultana 2002, Horner 2008), measurements of commute times, which tend to correlate with job-housing balances, will be included (Sultana 2000). Research on the mismatch of jobs to housing in suburban employment centers highlights commuting patterns and the demographic characteristics among residents and employees (Sultana 2002, Ma and Banister 2006). In Atlanta, specifically, employees of job-rich areas display high mean travel times, while residents of job-rich areas have low mean travel times (Sultana 2002). The work of Sultana supports the idea that job-rich edge city employees of the 90's suffer from long commuting times due to the lack of adequate housing stock (Sultana 2011). This concept will be addressed for the edge cities in this thesis as well.

Whether edge cities can manage the imbalance between their need for low wage workers in retail, entertainment, and personal services and the lack of affordable housing, may be based on measurements of the variety and availability of infrastructure (Beauregard 1995). If affordable housing cannot be had in close proximity to edge cities employment centers, then low wage workers would be required to commute from other areas, consequently requiring efficient public transportation that connect low wage edge city jobs to affordable housing.

The availability of low income employment opportunities in areas that do not provide affordable housing for low income populations extends beyond the jobs-housing balance and defines the spatial mismatch phenomenon (Holzer 1991, Taylor 1995).

While a balanced ratio of jobs to housing would suggest that an area exemplifies sustainability, if the residential options exclude the local workforce based on level of income, then there exists a spatial mismatch between employees and affordable housing. Measures of job accessibility associated with spatial mismatch often use commute times to highlight discrepancies among race and income levels (Sultana 2002, 2005). With documented levels of congestion and sprawl often among the worst in the US, shorter commuting times in Atlanta's edge cities could indicate similarities among wages and housing affordability. Atlanta is known for the suburbanization of jobs, leaving central city residents with few job opportunities close to their homes (Sultana 2005). Not only does the jobs-housing balance and spatial mismatch factor into the development of Atlanta's suburban landscape, but also racial segregation further complicates the potential for truly diverse suburban neighborhoods in terms of race, ethnicity and income.

For this study it is important to acknowledge that having a nearly equal job-housing balance alone is not an adequate justification for the claim of sustainable edge city development. Ideally, a mixture of ethnicity, race, incomes, housing and transportation options should be available to encourage sustainable development and reduce commute times.

2.2.4 Lack of Diversity

The demographic typology of edge cities has been described as homogeneous in terms of residential income, race and employment opportunities, thus creating a "sterile" landscape (Garreau 1991). A contribution to the public perceptions of racial and social composition in edge cities is credited to the exclusionary origins of available housing.

Often zoned as single family housing, many of the neighborhoods require a certain level of income that isolates lower income populations from potential employment opportunities found in edge cities (Beauregard 1995). To confront this criticism head on, Hall and Lee (2010) asked "How Diverse are US Suburbs?" Drawing from the perspective that suburban developments consist of predominantly white, middleclass homeowners, Hall and Lee conclude that in actuality suburban "rings" are equally if not more diverse than the corresponding central city. College Park, a newly developed edge city in Charlotte boasts a very high Asian population (Sultana 2011). The racial makeup of suburban areas in the Southeastern United States, including Atlanta, does include a prevalent African American middle class due to the suburbanization of the black population over the last three decades (Sultana 2005, Beauregard 1995). However, it has been shown that race-based suburbanization is still an issue since much of the movement of blacks into the suburbs did not occur in the same location as the concentrated employment centers that make up edge cities (Sultana 2005). While having an exclusionary effect on potential entry-level employees due to edge cities being too expensive to live in or drive to (Garreau 1991), the growth of employment opportunities in retail, entertainment and services needs to be complimented by affordable housing and transport options.

Race-based residential segregation is important in Atlanta for black workers seeking to live near suburban employment centers (Sultana 2005). However, research on Metro Atlanta racial diversity shows that discriminatory attitudes towards different races play a role suburban Atlanta residential choices and availability (Bullard et al 2000;

Holloway and Wyly 2001).The imbalance between affordable housing and low wage employment available in edge cities is a spatial mismatch resulting from the racial variation and exclusion of suburban residents of Atlanta (Sultana 2005, 2011). While it is commonly thought that whites are the primary occupants of suburban regions and blacks generally live in inner city neighborhood, the suburbanization of employment and job sprawl has established an unnatural need for low wage workers in retail, entertainment and services. The racial segregation in Atlanta's suburbs has in effect created a pool of low wage employment available to populations unable to afford housing nearby or commute to these areas from elsewhere in the city. Whether edge cities have managed to overcome the inherent spatial mismatch in incomes and race has yet to be explored.

The argument that edge cities specifically lack diversity has not been directly addressed, yet Garreau states in many ways that it is a potential non-issue due to the availability of a variety of employment opportunities. Often citing the existence of ethnic restaurants, universities and the overall appeal of "urban" life in the suburbs, Garreau suggests that racial and nativity diversity exists in edge cities. Recent studies show that new waves of immigration are increasingly settling away from the urban core in suburban areas and that by 2007 more than half of U.S immigrants lived in the suburbs of large cities (Frey and Singer 2009). By looking at the racial and immigrant demographics of edge city residents, this thesis will put a quantitative measure on the racial and cultural characteristics.

2.2.5 Transport Infrastructure

When comparing edge cities to traditional cities, an exploration of the built environment and its influence on social and economic activities provides a frame of reference. Garreau neglects to include criteria for elements of the urban infrastructure found in traditional downtowns that could potentially relate to elements found in edge cities. There are a number of reports that have developed a spatial typology for edge cities and compared it to traditional downtowns (Southworth 1993, Scheer and Petkov 1998). Instead of a traditional street grid common in downtowns and older neighborhoods, edge city street networks are characteristic of postwar suburban construction, and are typically based on a hierarchical system of winding parkways that feed into arterial roads or freeway ramps (Sultana 2011).

Additional research has concluded for the most part that edge cities often display an organization of land use patterns that separate the pedestrian from the vehicle and allow an abundance of space both for driving and parking vehicles (Southworth 1997). While one specific pattern doesn't necessarily apply to all edge cities, one common function is accommodating for an auto dependent workforce, resulting in low density office complexes among "six hundred square feet of retail" usually made possible by a regional shopping mall. The amount of vertical office space and retail commands a large quantity of land for parking alone, not including living space for employees. The principal finding in past research on edge city infrastructure emphasizes that the motivation behind the development of edge cities has been economic and commercially centered (Wheeler 2004).

In a report for the Victoria Transport Policy Institute, Litman (2011) described the impact that parking requirements have on housing affordability. The issue of parking and parking requirements are a relevant issue to edge cities since it is known that ample parking is a key characteristic of edge cities (Sultana 2011). Making available generous parking supply at place of work, shopping, and residence contradicts current efforts to reduce housing costs, environmental impacts and sprawl and to develop a more efficient and diverse transportation system (Litman 2011).

Attempts at retrofitting edge city developments are being used in some regions to show how certain concepts can be applied to support walkability and increased density (Swope 2009, Fishman 2005). The metro rail is set to open four stations to act as a catalyst for creating dense layers of urban form in Tyson Corner, one of the most famous edge cities in the US. Plans like these have potential to not just offer density but show how and if such options will be effective five and ten years into the future. One of the questions that comes up when debating the shortfalls of edge cities is if new initiatives aimed at sustainability and growth control are put into action, could these places still be considered edge cities? With the interests of urban planners and designers shifting toward transportation oriented developments (TOD) and traditional neighborhood developments (TND), one is to wonder when or if edge cities will become something else, possibly normal cities. A common theme among transportation oriented developments is to take into consideration both diversity and the human scale that directly addresses some of the issues surrounding edge cities (Fishman 2005). Additional measurements of commuting times and distances between edge cities and the CBD will

demonstrate whether edge cities sustain the idea of reduced congestion and outward expansion as a result of alternative transportation planning.

2.3 Edgeless Cities and Office Sprawl

A counter argument to the idea of edge cities as the way that the American suburb will develop is Robert E. Lang's (2003) edgeless cities concept. Edgeless cities represent a significant contrast to the defined form of traditional cities that edge cities attempt to replicate. Similar to edge cities, edgeless developments associated with the trend of decentralization have taken place over the last thirty years, to which both Lang (2003) and Garreau (1991) agree. While this research focuses on the efforts of developing edge cities into real cities, the concept of edgeless cities provides perspective on the greater issue of expanding low density development which has been shown to be a dominant trend in recent years. There are discrepancies in each theory. For example, two of the edge cities mentioned in Atlanta, GA, Buckhead and Midtown, are actually within the city boundaries, not exactly at the edge. In addition, Garreau states that due to decentralization of urban populations, there can be neighborhoods within the "urban" city core, that have residential densities similar to that found in suburban neighborhoods. In contrast, Lang (2003) argues that most new exurban developments resemble common low density suburbs, yet provide the same economic functions sought by edge cities.

For Lang, edgeless cities appear synonymous with job sprawl, both of which are primarily defined by rapid low density growth (Weber and Sultana 2008). While job sprawl can be seen as a disconnected process, edge cities set out to establish a district of concentrated employment, with a strategic location that systematically draws population

from surrounding areas in a way that puts an end to continued outward employment expansion (Sultana 2011). This thesis, thus, investigates whether suburban landscapes continued to resemble the edge city, edgeless city or office sprawl pattern.

In sum, a principal intention of this thesis is to address each criticism of edge cities through the use of publicly available Census data, looking specifically at whether claims against continued edge city development hold true. Edge city observations in this thesis are intended to show how edge cities can be ideal locations to direct smart growth planning and policy practices to retain growth in areas that are already developed. Creating dense, diverse residential and commercial opportunities can allow a variety of incomes and influence reduced car dependency, representing the new trend of sustainability that has potential in edge cities. Research argues in favor of smart growth concepts to balance jobs and housing, increase residential density and reduce commuting times (Weitz 2003).

CHAPTER III

RESEARCH DESIGN, DATA AND METHODS

3.1 Data

An important aspect of this thesis is to identify each edge city with an appropriate boundary so that they can be studied systematically. The Census Transportation Planning Package (CTPP) data provides detailed socioeconomic and commuting characteristics of workers based on place of residence (Part1) and place of work (Part 2) at Traffic Analysis Zones (TAZ) level, the smallest geographical unit with an estimated population of 600 to 1,200. By using CTPP data it is possible to identify employment centers or edge cities as data are given on how many workers are employed in each TAZ. The CTPP part 1 and 2 data from 1990 and 2000 are used to address the research questions raised in this thesis. CTPP also provides part 3 data that includes specific information on commuting patterns based on origin and destination, but was not necessary for the purpose of this study.

Additional publicly available data provided through the Atlanta Regional Commission (www.atlantaregional.com) includes the locations of Metropolitan Atlanta Rapid Transit Authority (MARTA) public transportation stations. Information related to the MARTA stations, particularly the year of construction and operation is available

online (www.itsmarta.com). The data related to the location of public transportation stations allows for the exploration of the influence that public transportation infrastructure may have on the development of edge cities. By looking at where new MARTA stations are put into operation in relation to where edge cities are developing or being established, the importance of public transportation in edge city development can be indicated.

3.2 Study Area

While this study could be replicated in metropolitan areas across the United States, it will focus on the Atlanta, Georgia metropolitan statistical area. The Atlanta metropolitan statistical area consisted of 28 counties; however, CTPP data are only available for 14 counties, which are known as the Atlanta region (Figure 3.1). The 14-county Atlanta region is highly urbanized, economically integrated, and is the largest metropolitan region in the Southeast. According to Garreau (1991), the Atlanta metro region in 1990 was comprised of four edge cites, the Cumberland Mall area, Perimeter Center area, Buckhead and Midtown, and three emerging edge cities, the Gwinnett Place Mall area, the Interstate 85 and 285 area, and the Airport area (Figure 3.2).

Since 1990, much of the Atlanta region has experienced substantial suburbanization of both population and employment opportunities. As the largest post-industrial city in the Southeastern U.S., the Atlanta economy is comprised largely of office, high-tech and service industries (Walcott 2006). A consideration as to the use of Atlanta in this study are the characteristics of Atlanta as having experienced racially segregated urban expansion and severe spatial mismatch among suburban employment

growth and inner city minority populations (Bullard 1999, Sultana 2005). Much of this uneven economic and racial distribution is spread out among Atlanta's employment centers at the fringe of the downtown area. In addition, several of Fortune 500 companies are located in the region (Garreau 1991, Gong and Wheeler 2007) and the Hartsfield-Jackson Atlanta International Airport has long been one of the most frequented in the U.S., further adding to the dynamic characteristics of the region (Airports Council International, www.aci.aero.com).

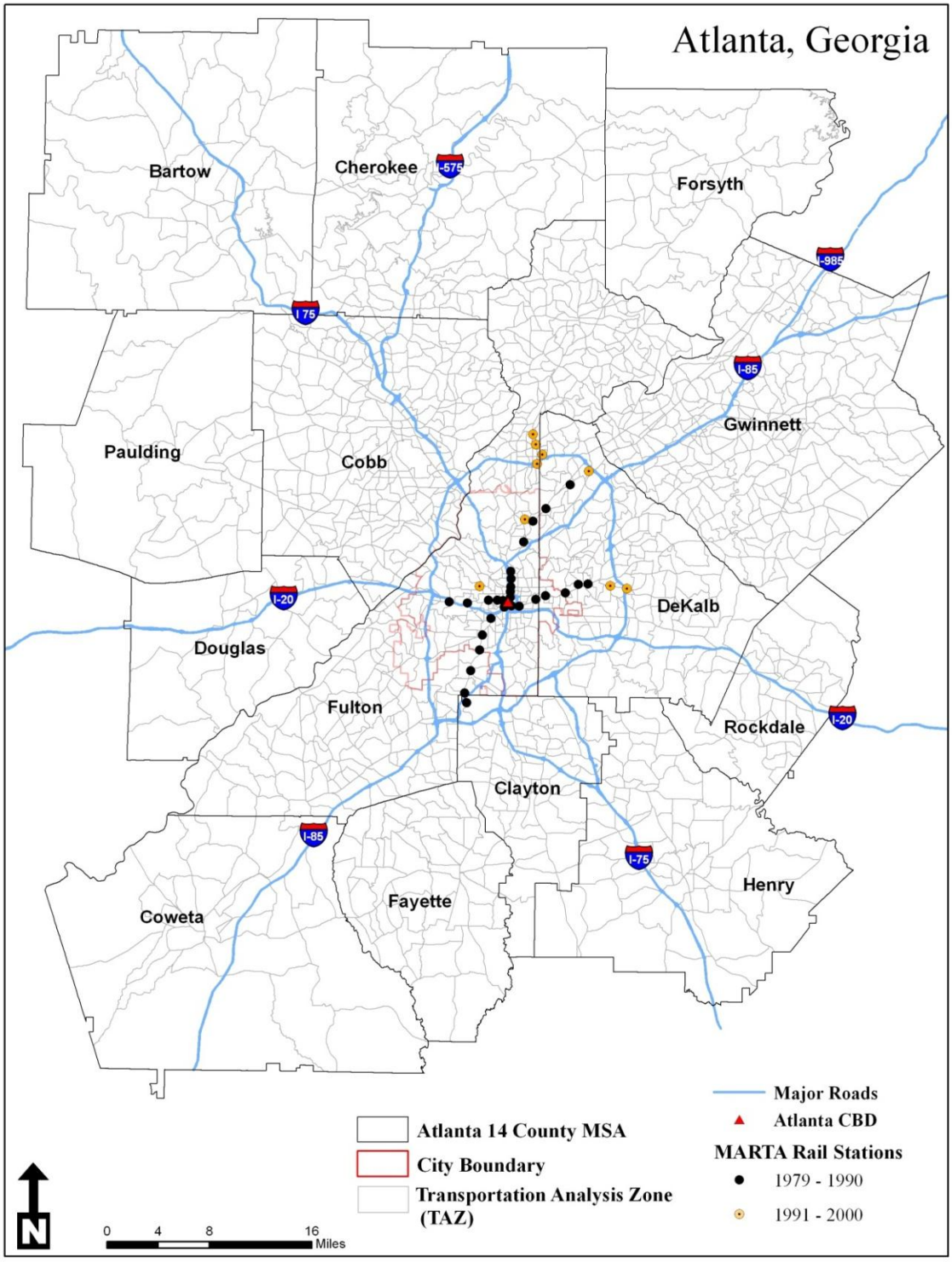

Figure 3.1 Atlanta 14 County MSA Study Area

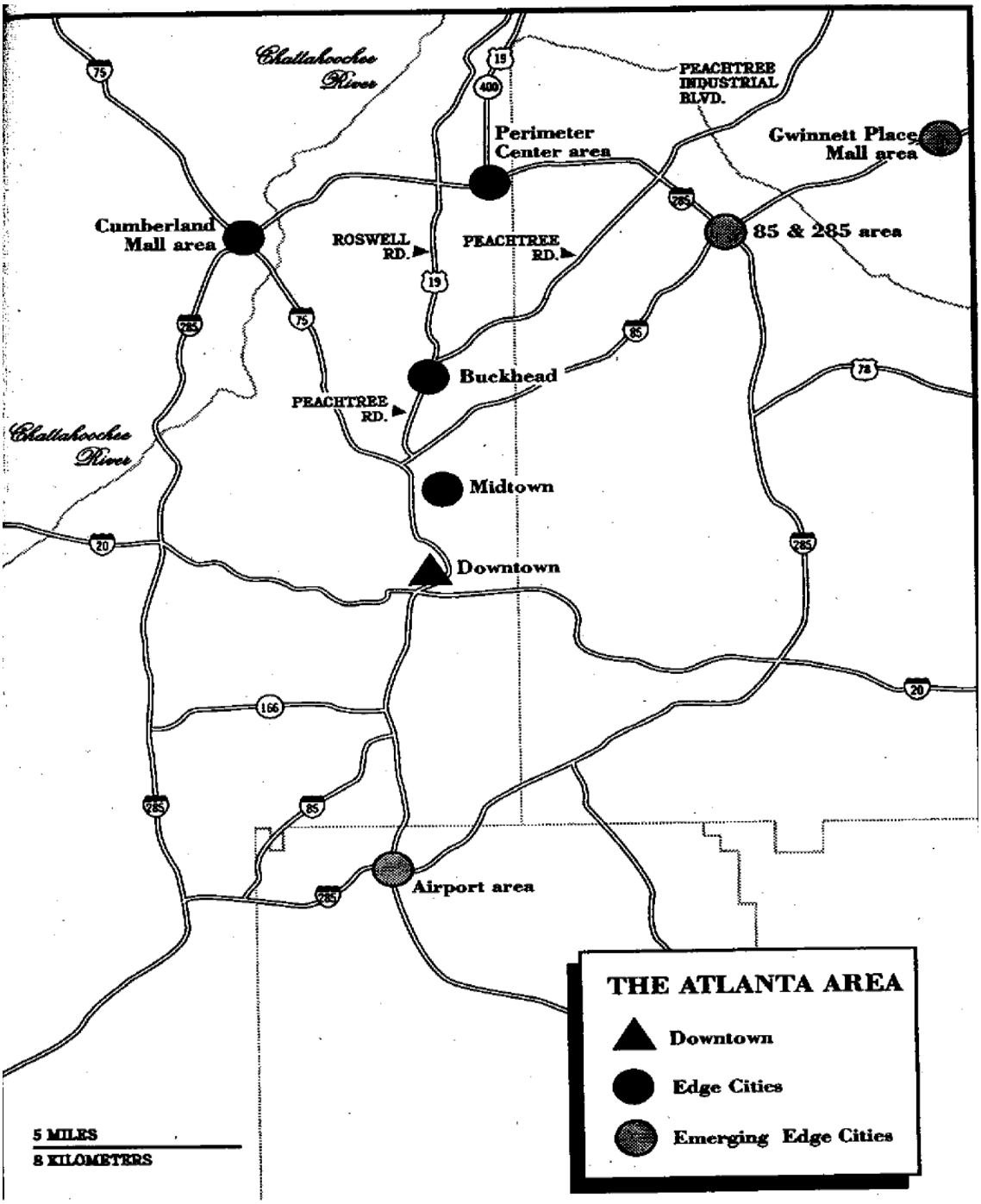

Figure 3.2 Garreau's Atlanta, 1990

3.3 Research Design and Methodology

A large issue surrounding the study of edge cities is determining the most appropriate method for accurately identifying their geographic boundaries to allow for systematic analysis. The criterion set out by Garreau emphasizes the role of office space, which implies the magnitude and types of employment, but the boundary issue remains vague. The availability of public data relating to the amount of office space is virtually nonexistent without the cooperation of privately run data collection services, particularly those relating to real-estate sales and leasing such as the now defunct Blacks Guide (www.blacksguide.com). Office space square footage data from commercial real-estate companies like Blacks Guide is often provided on a building by building basis with no geographical information besides street address. The process required to geo-locate each office building using its street address, then compile the total square feet of office space in each could result in inaccurate measurements of both location and office space type. For this reason and the length of time required, this method was not used for this research. While the former Blacks Guide did provide office space square footage data at the 5-digit zip code aggregation, combining this level of data with the much more detailed TAZ level would introduce data discrepancies and error, in addition to compromising the value of using data at the TAZ level of detail. TAZ data could be merged to fit into 5-digit zip codes using geographic information systems; however, this large of a boundary is also insufficient to identify the edge city phenomenon. Additionally, at the time of this research "Blacks Guide" had ceased publication of office space real estate figures due to the investment required to provide up to date online

commercial real estate market information (www.bizjournals.com/southflorida/blog/2010/10/blacks-guide-folds-local-publisher).

In order to analyze edge cities and changes in their characteristics over time from 1990 to 2000, a new method to identify edge cities was developed by combining an employment density threshold and a minimum total employment with types of job specialization. This method is a slightly modified version of the method originally developed by Giuliano and Small to study employment centers in Los Angeles (Giuliano and Small 1991). This method was later modified by Sultana (2000) to create a more appropriate application to the total population of Atlanta as compared to Los Angeles at the TAZ level. The CTPP Part 2 (place of employment) data provides industry and occupation types at TAZ levels, so it is possible to identify the areas that have high concentrations of employment as well as specialization of jobs. In this research, individual TAZ's having employment density (D) of 4 employees per acre or greater combined with total contiguous TAZ employment (E) of 10,000 employees were selected as employment centers (Sultana 2000). The edge city phenomenon is restricted to the suburban landscape since that was the original vision of Garreau (1991). For this reason, any employment centers located within the boundary of the central city of Atlanta (CBD) were not considered as edge cities and were considered as "urban employment centers."

To highlight certain employment centers as edge cities, the Location Quotient (LQ) is used to identify the occupational specialization of specific centers. The location quotient is a method of measuring industry specialization. In this study, industry

specialization is expressed by the share of employment in a given industry/occupation in a specific subarea (employment centers), as a percentage of the share of employment in the same industry/occupation within the larger area (Atlanta region) (Green and Pick 2006). A zone that has a location quotient greater than 1 (100%) indicates that the employment center is specialized in that particular sector of the industry/occupation. For this thesis, TAZ's with a LQ of 1.25 or greater in financial or office occupations/industries and sales or retail occupations/industries were selected from the existing employment centers as being edge cities. Using a LQ of 1.25 identifies each TAZ for having at least 25 percent or higher employment than if the TAZ reflected the metropolitan areas employment in the office and sales occupations and finance and retail industries. Additionally, once each edge city is identified, adjacent TAZ's identified as employment centers are added to the edge city to include contiguous zones of high employment density with the edge city boundary (Figure 3.3). The added complexity that is used to further emphasize the location of edge cities is what makes this research unlike any other that has been done before.

This study argues that the use of office space and retail square footage should be considered synonymous with employment in the office and retail based occupations and industries. The use of exact employment numbers given by the CTPP Part 2 "place of work" dataset present a more accurate picture of the edge city landscape based on the employment types suggested by Garreau's use of office space based measurements than the use of actual office space square footage. Limiting the scope of edge city identification to quantifications of office and retail space square footage does not

necessitate that employees actually occupy stated office space. Previous edge city research using real-estate listings as a source of office space square footage must acknowledge the fact that the office space in their research may be unoccupied (Bingham 1997; Lang 2003). Using measurements of "leasable" office space gives a false representation that there is a concentration of such employment. For these reasons, it is argued that the use of actual employment numbers are a more reliable and scientifically defendable source for determining suburban employment trends than available office space. Additionally, by restricting the specialization of employment to office, administrative, sales occupations and finance, insurance, real estate (FIRE), and retail industries, further can exclude employment in industries that may include small scale office space operations such as doctors' offices or manufacturing management that are not directly associated with the growth and development of edge city industries (Anderson and Bogart 2003; Lang 2007).

In addition, the web application of Google Maps (maps.google.com) is used to determine an identity for the edge cities in the Atlanta region. To address one of the controversies surrounding edge cities and their ambiguous nature, often not recognized as a distinct place (Garreau 1991), the use of Goggle Maps links edge cities of this thesis with geographically significant place names. In most cases, naming edge cities with this technique is relatively precise based on the economic nature of employment centers, particularly in areas dominated by a large shopping mall, industrial or office park, or transportation hub (Garreau 1991). The employment base typology of Metropolitan Atlanta will allow for analysis of the status of edge cities in both 1990 and 2000.

Specifically, the delineation of boundaries around edge cities and employment centers based on TAZ zones shows the potential to spatially organize the suburban landscape into "pockets" of economic development, particularly important in the case of edge cities which are a target of criticism due to the historical lack of identifiable boundaries. No other edge city research has made the effort to define the boundaries of edge cities at a level of aggregation comparable to the TAZ zone using measurements of actual employment. With the addition of other relevant categories that are exclusive of edge cities, one can compare the change in edge cities over time to the change in other categories, as well as to the total change in employment for the entire metropolitan region.

To examine the question of whether suburban landscapes have continued to resemble the edge city pattern or edgeless city or office sprawl pattern, the additional areas that do not meet the edge city criteria require unique categorization. Employment centers that do not show a specialization in both office and retail employment are simply recognized as "employment centers." As mentioned earlier, employment centers are also identified as either being part of the urban setting, or outside of the urban setting functioning as suburban employment centers. Lastly, all other TAZ's that do not meet edge cities or employment center criteria are grouped into edgeless or job sprawl development, having both low employment density and low total employment (Lang 2003; Sultana and Weber 2008). For this research, the term edgeless city or job sprawl is interchangeably used. Employment sprawl in this thesis will be recognized as the discontiguous regions that do not fit into the criteria of edge cities, suburban employment

centers or urban employment centers. This method of classification is used for both 1990 and 2000 to appropriately compare and explore the changes between years.

Whether or not edge cities of suburban Atlanta will experience continued development without integrating new urbanism and smart growth practices could rely on the implementation of these concepts. Variables such as commuting times, vehicles per capita, housing density, use and availability of alternative and active modes of transportation are used to address the existence of smart urbanism practices. To examine the use of transportation in edge cities and approach the issue of impractical parking resources, this study will examine measurements of public transportation use, vehicles per capita (number of vehicles per 1,000 people), non-car commuters, families using fewer than two vehicles, and commuting times as indicators of transportation infrastructure aptness. By using these measurements one can assess the efforts of edge cites to reduce the dependence on the automobile and the amount of land dedicated to its use. The problem with an indirect measure of parking space is that employee and residential behavior in terms of auto use would in many cases be predetermined by the infrastructure already developed in edge cities. In other words, ample parking encourages the use of the private automobile. However, evaluation of the transportation condition based on employee and resident reliance on personal vehicles for transportation may show that such unsustainable characteristics of edge cities are unnecessary. While one specific pattern does not necessarily apply to all edge cities, one common function is accommodating for an auto-dependent workforce, resulting in low density office complexes among "six hundred square feet of retail," usually made possible with a

regional mall. The amount of vertical office space and retail commands a large quantity of land for parking alone, not including living space for employees.

With an absence of publicly available data related to measurements of sidewalk usage and existence, or specific ways to measure bike lane usage, alternative methods of analysis are used to draw a conclusion related to these aspects of smart urbanism. The thought is that if an edge city or employment center has a significant portion of residents or employees walking, biking, or using public transportation, then it can be assumed that facilities such as sidewalks, bike lanes, and public transportation stops that promote these uses are part of the typology for this area. According to a recent study looking at sustainable travel behavior, it has been shown that greater public transportation supply and higher population densities can reduce auto dependence, vehicle miles traveled and commuting distances (Kahn, Morris 2009). The lack of automobile reliance as measured by few vehicles per capita and a significant portion of families having fewer than two cars would also suggest that smart urbanism practices aimed at improving non-motorized and public accessibility are influential in these areas (Wheeler 2004). One method of promoting more compact and economically efficient neighborhoods is through increased density, another tool used in smart urbanism that for this research is measured directly by housing density. Where housing density is higher, it can be assumed that residential development in these areas is characterized by compact lot sizes and limited outward expansion. Besides density, a commonly used measurement when describing a city's existing and long term potential for long term sustainability and smart growth is the jobs-housing balance. For this study, the jobs-housing balance is portrayed in the ratio of the

number of workers in one area (jobs) divided into the number of housing units in the same area (housing). An ancillary variable that was included to give a picture of the overall centrality or compactness of the Atlanta metro and give a detailed perspective on the pattern of employment center and edge city locations was a measurement of average distance to the CBD (Lang 2003). This distance to CBD measurement is an average of the distances from each individual employment centers center point (as calculated in a GIS environment) to the CBD, for both 1990 and 2000.

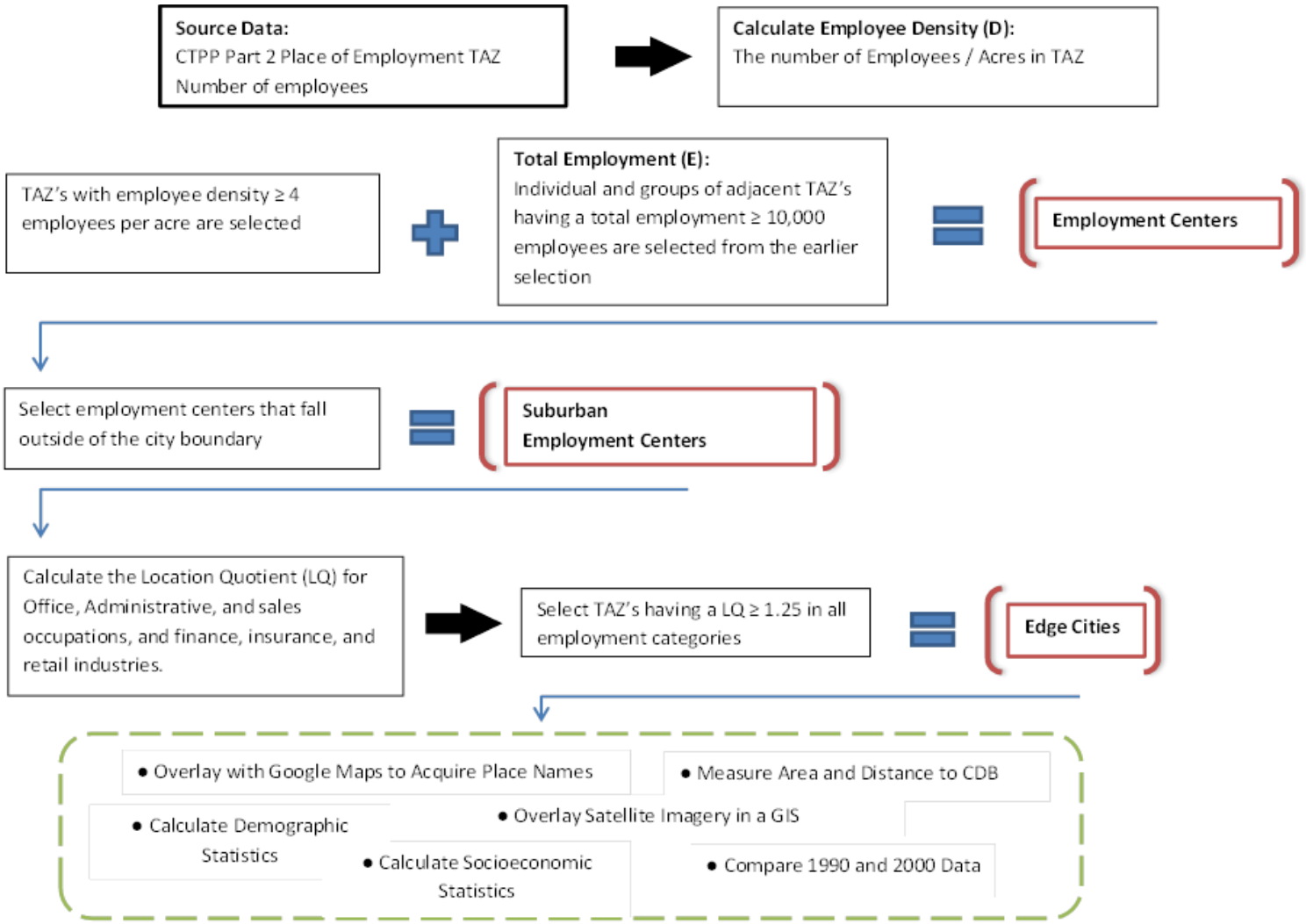

Figure 3.3 Research Design Flow Chart for Edge City Identification

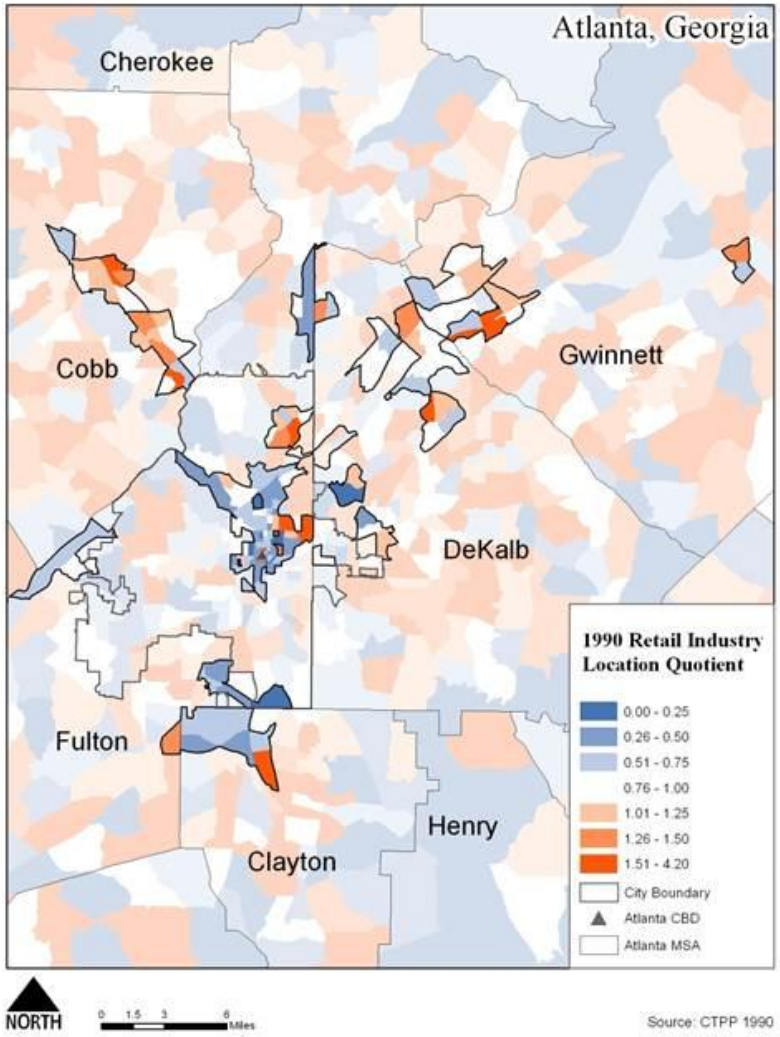

Figure 3.4 1990 Retail Industry Location Quotient

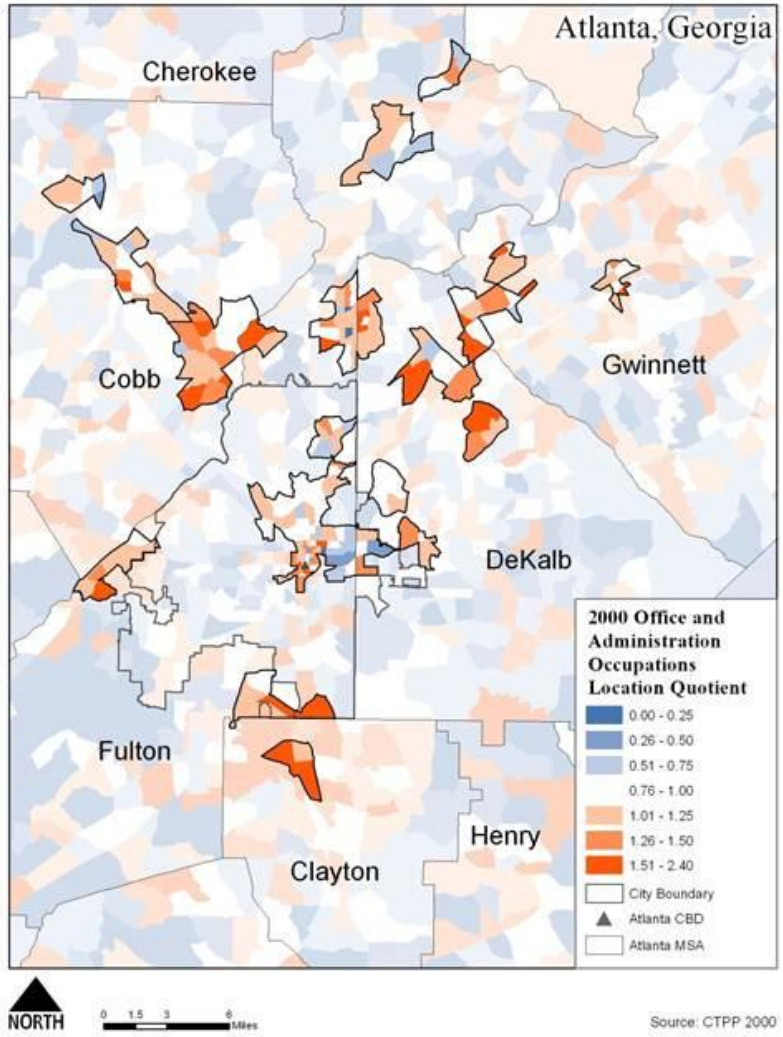

Figure 3.5 2000 Office Administration Occupations Location Quotient

CHAPTER IV

FINDINGS

4.1 Edge Cities in Transition: 1990 to 2000

As mentioned in the study area section, Garreau (1991) identified four existing edge cites and three "emerging" edge cities in the Atlanta, GA region. Of the four edge cities identified by Garreau (Buckhead, Midtown, Perimeter Center and the Cumberland Mall Area), Midtown and Buckhead are considered part of Atlanta's urban employment centers for this study due to their location within the Atlanta city limits. Garreau's discussion of Atlanta's edge cities is clearly misleading or inconsistent as many researchers have recognized in the past (Lang 2003, Ding and Bingham 2000, Sultana 2011). By definition, edge cities should be located in the suburban perimeter not within the city (Sultana 2011). The two other edge cities mentioned by Garreau include Perimeter Center and the Cumberland Mall area which are both identified as edge cities using the 1990 CTPP data. Of the three emerging edge cities Garreau recognized, Gwinnet Place Mall and Perimeter/I-85 did become edge cities in 2000; however, the Hartsfield Airport area met the edge city criteria of this study in both 1990 and 2000. It is interesting to note that while Garreau identified the Hartsfield Airport area as an emerging edge city, it actually met the requirements of an edge city in this study based on the office and retail employment. Using the criteria defined earlier, TAZ's were able to

be successfully differentiated into each employment cluster type, edge cities, urban employment centers, suburban employment centers and edgeless developments.

Two edge cities identified in 1990 did not exist in 2000, and four new edge cities were noted in 2000, accounting for the increase in the number of identifiable edge cities from six in 1990 to eight in 2000 (Table 4.1). The four new edge cities established in 2000 exhibit an interesting trend towards the adoption of edge city growth patterns. Of the two edge cities lost since 1990, Doraville and South Norcross/I-85, Doraville exists as a suburban employment center in 2000, while South Norcross/I-85 has "disappeared" completely as a concentration of employment. Among the four new edge cities in 2000, two were former 1990 employment centers, I-85/285 area and the Fulton Industrial area. The two other edge cities that are newly established in 2000 include the area between Roswell and Alpharetta and the Gwinnett Place Mall area, both which went from nothing to edge city status in the ten year time span. The increase of edge cities can be explained by the transition of some 1990 employment centers to edge cities, also shown by the slight decrease in the acreage of employment centers from 19,700 to 18,300. Since some 1990 employment centers did not become edge cities in 2000, this study could serve to show that those employment centers serve as a stepping stone to edge city developments. The potential locations for edge city development can be found in current suburban employment centers (Figures 4.2 and 4.3). For example, new and forthcoming edge cities could possibly be found in the areas of Peachtree Corners, Marietta, Town Center at Cobb and North Alpharetta.

The trend towards urban redevelopment and new urbanism, as mentioned earlier, is displayed by the increase in urban employment center acreage from 15,400 to 17,100 in combination with fewer centers, displaying a movement towards concentration around the traditional urban core. Edgeless development, representing job sprawl type of developments that lack centrality, could not accurately be quantified using a method of identifying centers. This is because edgeless developments and job sprawl have no recognizable pattern of development that could be identified through the means of measurements carried out in this study to identify employment centers and edge cities. Since edgeless developments and job sprawl cannot be tied to a particular location that has a recognizable boundary dividing one area of job sprawl from another area, edgeless developments and job sprawl could not be measured by a number of clusters or centers in this study.

Table 4.1 Edge City, Edgeless, Urban and Suburban Employment Center Numbers and Size

	1990		2000	
Atlanta, GA MSA	Number of Centers	Area in Acres	Number of Centers	Area in Acres
Urban Employment Centers	4	15,432	3	17,174
Suburban Employment Centers	7	19,773	7	18,333
Edge Cities	6	21,383	8	33,047
Edgeless (all other)	NA	NA	NA	NA
Source: CTPP 1990, 2000				

One of the strongest findings in this study was the overall growth in the amount of land classified as edge cities, from 21,300 acres in 1990 to over 33,000 acres in 2000. This change in total area classified as edge cities can be seen in Figure 4.1. While urban employment centers and edge cities experienced a growth in acreage, suburban employment centers decreased in area by roughly 1,000 acres, likely acreage that has transitioned to edge cities. Increases in land area for both edge cities and urban employment centers exhibit the idea that these areas are of growing interest to employers and developers. There also may be some similarities in the characteristics of these two areas as expected.

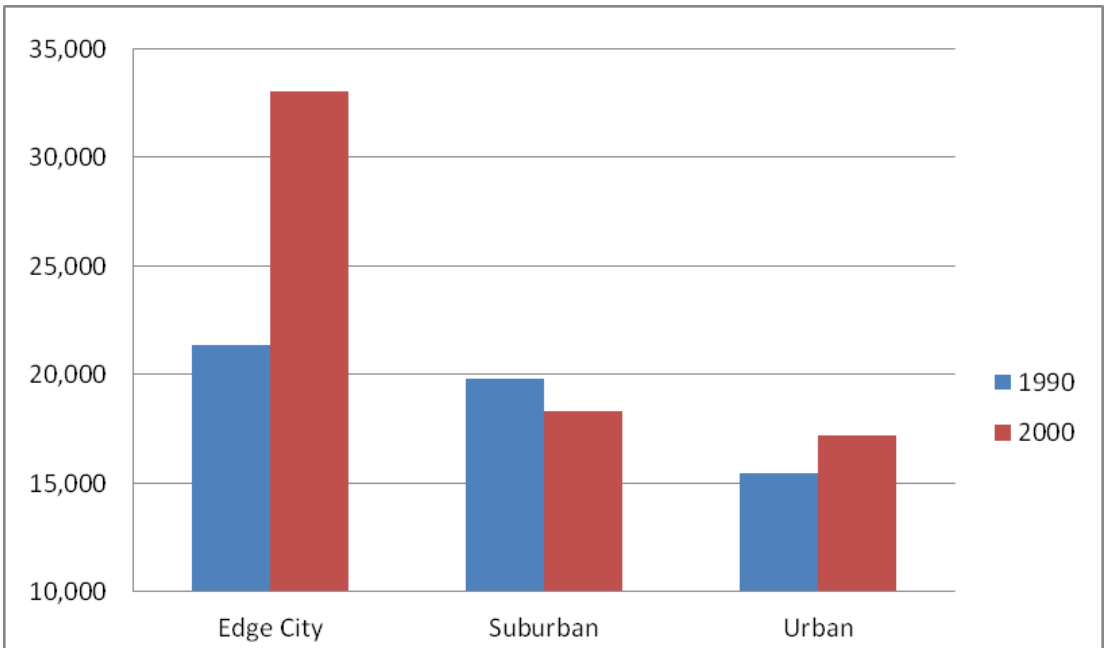

Figure 4.1 Area in Acres of Each Region, 1990-2000

Source: CTPP 1990, 2000

Locations of both employment centers and edge cities in 1990 are concentrated along the I-285 perimeter expressway and in the northeast along the I-85 corridor, with the exception of the edge city at the airport (Figure 4.2). In the northwest along Interstate 75 just south of I-575 is the Marietta employment center, which is 12.8 miles from the CBD (Table 4.2). The northeastern portion of the study area contains the employment center in Lawrenceville, 26 miles from the CBD, and the edge city of South Norcross/I-85, 13.6 miles from the CBD, being the two farthest from the CBD in 1990. The Cumberland Mall edge city along I-285, 8.7 miles northwest of the CBD along the city boundary, represents the characteristic edge city identified by Garreau, based around a mall, and meeting the criteria again in 2000. Some 9.3 miles directly to the north of the CBD is another classic edge city based around the Perimeter Center (Figures 4.2,3, and 4) shopping and office area. To the northeast along the I-85 corridor, 10.9 miles out the city center, there is an employment center near the I-285 perimeter expressway. This area, called merely the 85/285 area, was mentioned by Garreau as an emerging edge city and based on the criteria for this study it does grow into an edge city in 2000. Clustered near the I-85/285 interchange are the Norcross/Peachtree corners employment center and the Doraville and Northlake Mall edge cities. To the east of the city boundary inside I-285, there are the employment centers of North Druid Hills and Decatur, both about 4.5 miles east of the CBD. Just south of the CBD, the southern portion of the Hartsfield Airport combined with the Southlake Mall, creates the only edge city in the southern part of the MSA, which is roughly eight miles away from the CBD. The only employment center

west of the CDB is found in an area known as Fulton Industrial, seven miles west of the city center. (**Table 4.2**)

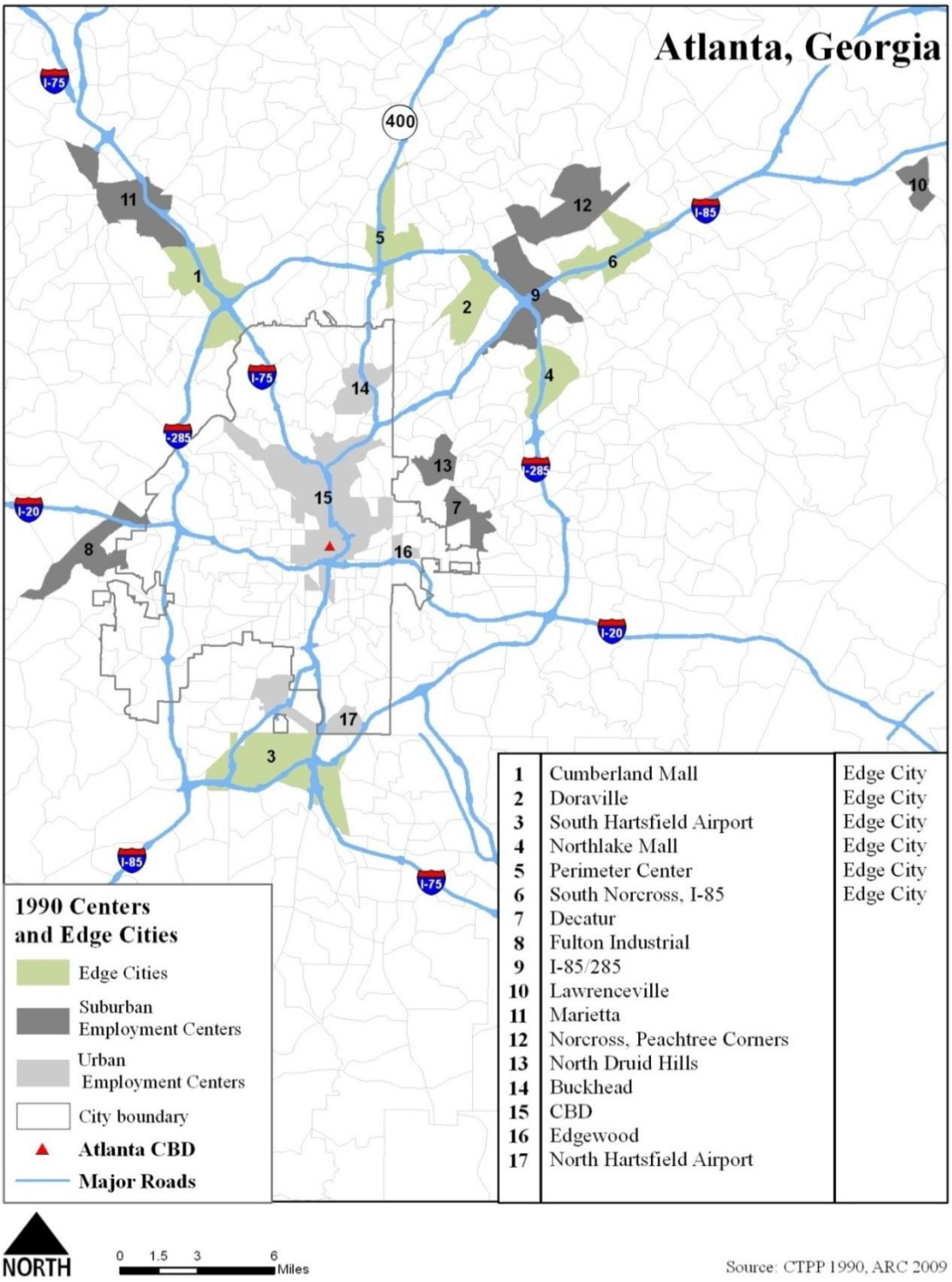

Figure 4.2 1990 Edge Cities and Employment Centers

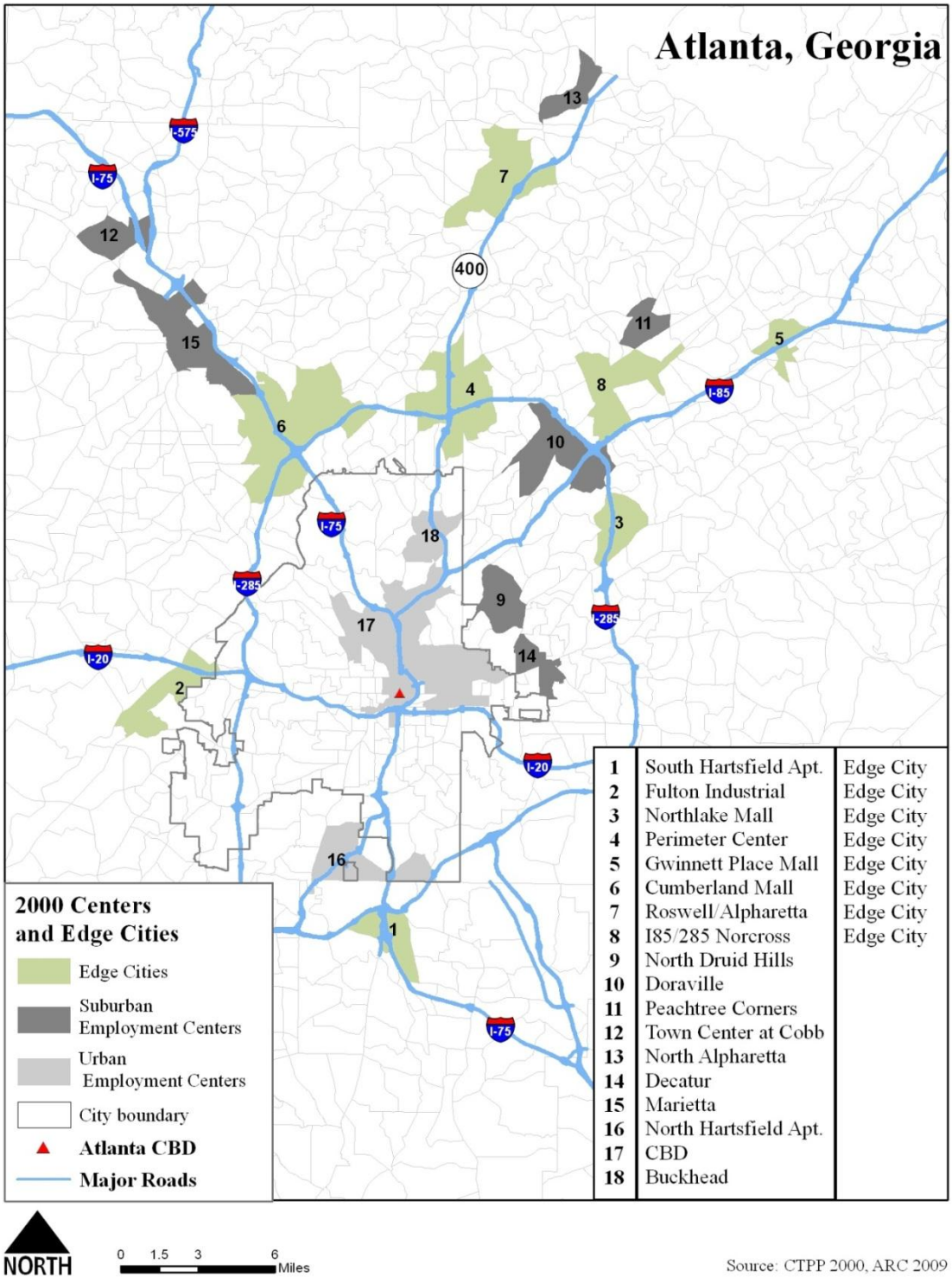

Figure 4.3 2000 Edge Cities and Employment Centers

Table 4.2 List of Edge Cities and Their Size, 1990 and 2000

Employment Center Name	Type 1990	1990 Size in Acres	Type 2000	2000 Size in Acres	Miles to CBD
Cumberland Mall	Edge City	4103	Edge City	9589	8.7
Doraville	Edge City	2358	Suburban	4546	9.0
Gwinnett Place Mall	NA	-	Edge City	1329	19.1
Northlake Mall	Edge City	2334	Edge City	2322	9.1
Perimeter Center	Edge City	2827	Edge City	5339	9.3
Roswell/Alpharetta	NA	-	Edge City	4826	18.2
South Hartsfield Apt.	Edge City	6655	Edge City	2215	7.9
South Norcross, I-85	Edge City	3106	NA	-	13.6
Decatur	Suburban	1441	Suburban	1452	4.3
Fulton Industrial	Suburban	3119	Edge City	2934	7.0
I-85/285	Suburban	4361	Edge City	4023	10.9
Lawrenceville	Suburban	1045	NA	-	26.2
Marietta	Suburban	4238	Suburban	5133	12.8
Norcross, Peachtree Corners	Suburban	4321	Suburban	1377	15.1
North Alpharetta	NA	-	Suburban	1550	22.8
North Druid Hills	Suburban	1248	Suburban	2184	4.3
Town Center at Cobb	NA	-	Suburban	2091	19.6
Buckhead	Urban	1881	Urban	1881	5.1
CBD	Urban	10753	Urban	11346	0.0
Edgewood	Urban	409	NA	-	2.4
North Hartsfield Apt.	Urban	2389	Urban	3666	5.2
*NA: Did not meet the critera for an edge city or employment center in 1990 or 2000					
Source: CTPP 1990, 2000, ARC 2009					

Picture Source: Costar 2011

Figure 4.4 Perimeter Center Edge City

The average distances to the CBD for employment centers and edge cities can be seen in Figure 4.5. The average for both edge cities and employment centers had moved farther away from the central downtown in 2000. An additional observation of importance relating to the distribution of edge cities is that much of the new edge city growth in 2000 has occurred farther out along major corridors of transportation near the

"edge" and away from the city center, particularly with the edge cities at Alpharetta/Roswell and Gwinnett Place Mall (Figure 4.2 and 4.3).

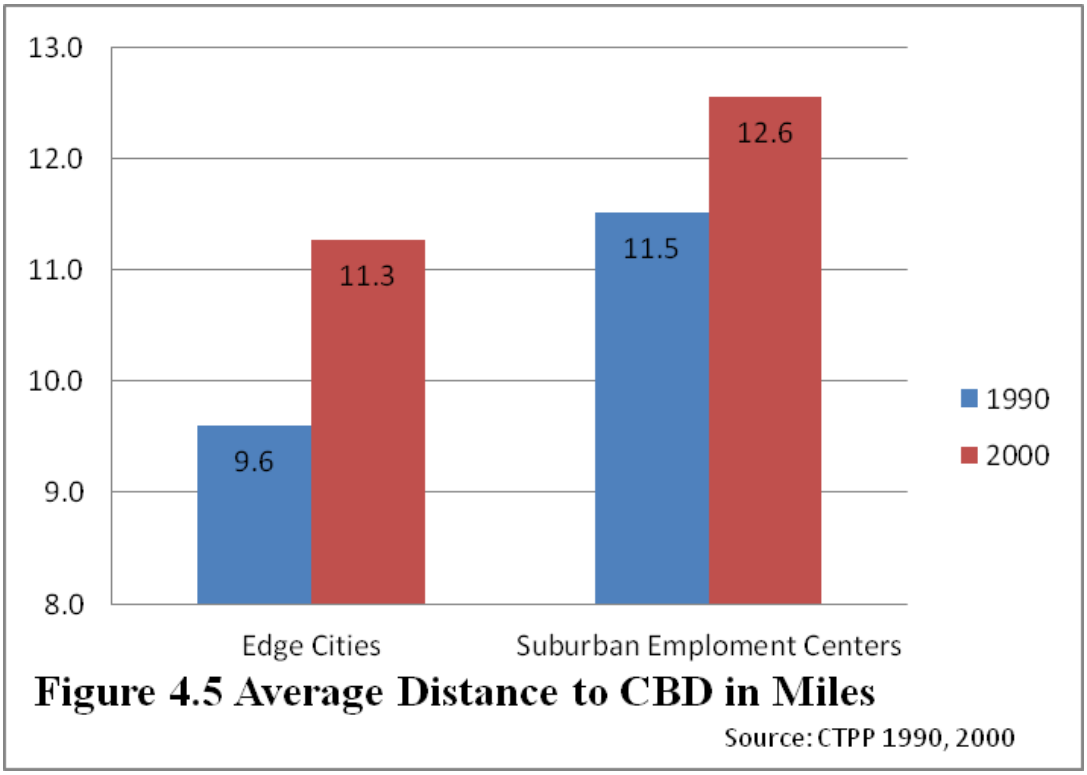

Figure 4.5 Average Distance to CBD in Miles

Source: CTPP 1990, 2000

In 2000, the majority of the edge cities expanded and clustered near major transportation corridors, including the intersections of I-285 and the I-85 and I-75 expressways, with a new edge city in the far north and northwest parts of the study area. While eight of the edge cities employment centers are the same as in 1990, some new ones are in different parts of the Atlanta MSA. The overall distance at which employment centers are located in 2000 are much farther north than in 1990. Just about 23 miles north of the CBD is the employment center around Alpharetta. Just to its south is an edge city between Alpharetta and Roswell. With the exception of the small edge

city around Gwinnett Place Mall 19 miles northeast of the CBD and the other previously mentioned edge city in northern Fulton County, all other edge cities are within 10 miles of the CBD, and all of the edge cities are adjacent to a major expressway, showing a very deliberate transportation based development pattern (Figure 4.3, 4.21). Northwest of the city boundary along the I-75 corridor there is an employment center at the Town Center at Cobb, 19 miles from the CBD. Working towards the CBD, adjacent to the I-75 expressway, is the employment center at Marietta and the Cumberland Mall area edge city (Figure 4.6), which is 10 miles from the downtown. Moving east along the perimeter expressway, and 9.3 miles directly north of the city, is the Perimeter Center edge city. Employment centers in the northeast part of the city include Doraville and Peachtree Corners, nine to 15 miles, respectively, from the CBD. The edge cities in this region include the I-85/285 area, 10 miles out on I-85, Northlake Mall along I-285, with the Gwinnet Place Mall farther out along I-85, 19 miles away from the CBD, all of which are clustered close to expressway interchanges. Major employment centers along the east side of the city are unchanged since 1990 and include North Druid Hills, and Decatur, roughly five miles away from the CBD directly adjacent to the city boundary. South, just outside the city boundary, the South Hartsfield Airport/Southlake Mall edge city lies roughly eight miles away from the CBD. A new edge city west of the CBD has developed at the former Fulton Industrial employment center. (See Figure 4.3 and Table 4.2.)

From 1990 to 2000, both the number of edge cities and the total amount of land within edge cities has increased. This increase shows that the edge city developmental pattern did partially contribute to suburban growth from 1990 to 2000 in the Atlanta region, answering the question as to whether edge cities would continue to develop beyond Garreau's observed edge cities. Additionally, the growth of land in edge cities places edge cities at a larger share of land than found in urban and suburban employment centers. This emphasizes the importance of the two contrasting ideas that contribute to suburban growth, edge cities and edgeless developments, as they are the two suburban developmental patterns commanding the largest share of land in the Atlanta region. Looking at the locations and distribution of edge cities, it is apparent that the use of the personal automobile has played a significant role in the shaping of new edge cities in Atlanta. With an average increase in the distance to the CBD for edge cities combined with the geographical adjacency to major transportation corridors, the personal automobile appears to aid in the expansion of edge cities both in size and location. Additional observations when looking at the distribution of edge cities and employment centers in both 1990 and 2000 is the general lack of significant centers and edge cities directly to the south of the central city. This reinforces the publicized isolation of employment opportunities in the northern part of the region (Sultana 2002). This unbalanced growth has the effect of separating residents in the southern part of the region away from large concentrations of employment opportunities. Shown by the expansion of edge cities and employment centers farther north away from the city in 2000, many of

these opportunities have become even more unavailable to southern populations than they already were.

Picture Source: Costar 2011, Google Maps 2011

Figure 4.6 Cumberland Mall Edge City

4.2 Employment Share in Centers, Edge Cities and Edgeless Cities: 1990 to 2000

A primary component of this research is to show if a trend exists in edge city employment share. By looking at the numbers and percentages of employment in each area over time, one can see where employment is increasing and decreasing. Emphasizing the changes in the share of employment in each region specifically will determine very directly if employment in edge cities and suburban employment centers are increasing or decreasing between 1990 and 2000. The entire Atlanta MSA had a residential population increase of 1,101,919 people, while employment grew by 597,509 employees from 1990 to 2000 (Table 4.4). Table 4.4 displays the change of the total growth in both employees and residents and in each employment region as a percentage of the total change for the entire Atlanta area. Edge cities contributed 16 percent of the growth in employment, a distant second to edgeless developments (76%). The rapid expansion of employment growth in edge cities shows that commercial developments have continued to influence employment location choices, in addition to putting growing pressure and stress on the infrastructure and natural resources of the fast growing regions. The change in population and employee density for each region is discussed later.

Table 4.3 1990 and 2000 Population in Real Numbers and Percentage of Total

Metropolitan Population	Edge Cities	Suburban Employment Centers	Urban Employment Centers	Edgeless (all other)	TOTAL
1990: Residential	47,843	57,340	98,573	2,468,955	2,672,711
1990: Residential %	2%	2%	4%	92%	100%
1990: Working	189,225	170,290	319,561	720,857	1,399,933
1990: Working %	14%	12%	23%	51%	100%
2000: Residential	100,509	71,704	113,400	3,489,017	3,774,630
2000: Residential %	3%	2%	3%	92%	100%
2000: Working	286,720	162,215	371,690	1,176,817	1,997,442
2000: Working %	14%	8%	19%	59%	100%
Source: CTPP 1990, 2000					

Table 4.4 Population Change in Each Region in Real Numbers and Percentage of Total

Metropolitan Population Change	Edge Cities	Suburban Employment Centers	Urban Employment Centers	Edgeless (all other)	TOTAL
1990-2000: Residential	52,666	14,364	14,827	1,020,062	1,101,919
1990-2000: Working	97,495	-8,075	52,129	455,960	597,509
1990-2000: Residential %	5%	1%	1%	93%	100%
1990-2000: Working %	16%	-1%	9%	76%	100%
Source: CTPP 1990, 2000					

As a percentage of the total metropolitan employment in the 1990 Atlanta MSA, the six areas identified as edge cities made up 14 percent (Table 4.3). In areas identified as edgeless, 51 percent of the total metropolitan employment accounted for the largest portion. Of the entire Atlanta residential population, only two percent were living in edge cities in 1990, while nearly all of the residential population in 1990 was living in edgeless developments at 92 percent. In the 2000 Atlanta MSA, urban employment centers

accounted for 19 percent of workers, while the eight areas identified as edge cities made up 14 percent of the entire MSA's employment. Edgeless cities accounted for 59 percent of the total MSA employees in 2000. As a percentage of the entire residential population of Atlanta, suburban employment centers contained the lowest share of residents at two percent; edgeless contained 92 percent, and three percent of the total MSA population was living in edge cities in 2000.

The change in employment distribution from 1990 to 2000 as seen in Table 4.4 proves an interesting outlook for edge cities, urban employment centers and edgeless developments. Edge cities contain the second largest share of total employment in 2000. This agrees with similar research stating that office based employment in particular is often higher in edge cities than in traditional urban cores (Garreau 1991, Lang 2003), combined with the fact that a significant portion of the employment in Atlanta is office based (Sultana 2005). The high percentage of employment growth in urban employment centers (9%) also shows the trend towards re-vitalizing downtowns and urban cores to appeal to new urbanism and smart growth advocates. The largest percentage of employment growth however exists in edgeless cities. This shows that despite the growth in urban employment centers and edge cities, there still is a market in for edgeless office sprawl type developments. These findings suggest that employers appear to be motivated by smart urbanism concepts to relocate to either traditional urban centers or newly developed edge cities that exhibit smart urbanism practices.

4.3 Diversity in Centers, Edge Cities and Edgeless Cities: 1990 to 2000

Diversity as measured by the percentage of the population share in each racial category was looked at in this thesis. The two different ways that racial diversity was measured included the share of each racial group as a percentage of the total population for the entire Atlanta region (Table 4.5). The other way that this variable was explored for this thesis included measuring the share of each racial group as a percentage of the total population within each economic region subgroup. These two methods provide a comparison of the share of racial diversity in each region to that of the entire Atlanta regions share of racial diversity (Table 4.6).

Table 4.5 Race as a Percent of Total Metropolitan Working and Residential Population

Percent of Total Population	Edge Cities	Suburban Employment Centers	Urban Employment Centers	Edgeless (all other)	Total
1990					
White Working	10%	9%	14%	40%	73%
Black Working	2%	2%	8%	10%	22%
Other Working	0%	0%	1%	1%	3%
Hispanic Working	0%	0%	0%	1%	2%
Total	14%	12%	23%	51%	100%
White Residential	1%	2%	2%	68%	73%
Black Residential	0%	0%	1%	20%	22%
Other Residential	0%	0%	0%	2%	3%
Hispanic Residential	0%	0%	0%	2%	2%
Total	2%	2%	3%	92%	100%
2000					
White Working	9%	5%	10%	39%	63%
Black Working	3%	2%	6%	13%	24%
Other Working	1%	1%	1%	4%	7%
Hispanic Working	1%	1%	1%	4%	6%
Total	14%	8%	18%	59%	100%
White Residential	2%	1%	2%	56%	61%
Black Residential	1%	0%	1%	23%	25%
Other Residential	0%	0%	0%	7%	8%
Hispanic Residential	0%	0%	0%	5%	6%
Total	3%	2%	3%	91%	100%
1990-2000					
White Working	6%	-4%	2%	37%	41%
Black Working	5%	1%	3%	19%	28%
Other Working	3%	2%	3%	10%	17%
Hispanic Working	2%	1%	2%	9%	14%
Total	16%	0%	9%	75%	100%
White Residential	3%	0%	1%	28%	32%
Black Residential	1%	0%	0%	31%	31%
Other Residential	1%	1%	1%	17%	20%
Hispanic Residential	1%	1%	1%	14%	16%
Total	6%	2%	2%	89%	100%
Source: CTPP 1990, 2000					

Looking at the share of racial diversity among the entire Atlanta regional population in 1990 (Table 4.5), 73 percent of the working population in Atlanta was White while Blacks represented 22 percent of the employed Atlanta MSA. Other races accounted for three percent of the total working populations, while two percent of the working population was Hispanic. The racial breakdown of 1990 urban, suburban employment center, edge city and edgeless residents and workers can be seen in Table 4.5. In 2000, 63 percent of the employed population in the Atlanta MSA was White, while 24 percent was Black. In 2000, the data for Asian populations were provided with its own category, but was grouped with the other races category for comparison to the 1990 data. Other races accounted for seven percent of the working population. Roughly six percent of the working population in 2000 Atlanta was of Hispanic origin.

The change in population among the different racial groups from 1990 to 2000 can also be seen in Table 4.5. Changes in each group are represented as a percentage of either the total change in MSA workers or in the MSA residential population. Interestingly, the urban and suburban employment centers showed nearly no change at all in the residential population, with just a small employment loss among whites in suburban employment centers. Edge cities showed a growth in employment among all racial groups as did edgeless cities. Edgeless cities saw an increase among the residential population and the workforce within in each racial group. The increase of minority populations in edge cities displays a demographic transition from past research. While

edge city populations are still predominantly white, growth in minority populations shows that edge cities are diversifying their demographic makeup (Hall and Lee 2010).

When looking at the racial breakdown as a percentage of the employee and residential population in each economic sub-region, the 1990 edge cities show above average percentage of white employees (77% vs. 73%) and a less than average percentage of black employees (18% vs. 22%). (See Table 4.6.) This would be expected based on much of the research describing the growth of edge cities and the homogenous workforce often associated with them (Garreau 1991, Hall and Lee 2010). When looking at the residential populations of both suburban employment centers and edge cities, the percentage of minority populations is higher than found in urban employment centers, edgeless cities and the Atlanta regions as a whole. In 2000, the share of "other" and Hispanic residential populations in edge cities was among the highest (13% and 12%), in addition to having a lower than average share of white residential population (59%). This change in residential diversity identifies a potential trend that, in the future, could challenge the idea that edge cities are comprised of predominantly white residents. Edge cities are showing an increase in percentages of growth among every racial category of population. Suburban employment centers display a decline in the percent of white residents and employees, while urban employment centers are showing a decline in the percentage of black residents. Similarities of diversity in terms of comparing edge cities to urban employment centers show that racially diverse populations often found in the urban core are also becoming more common in edge cities as well.

Table 4.6 Race as a Percent of Working and Residential Population in Each Region

Percent of Population in Each Region	Edge Cities	Suburban Employment Centers	Urban Employment Centers	Edgeless (all other)	Atlanta Region
1990					
White Working	77%	75%	62%	77%	73%
Black Working	18%	20%	33%	19%	22%
Other Working	3%	3%	3%	3%	3%
Hispanic Working	2%	2%	2%	2%	2%
Total	100%	100%	100%	100%	100%
White Residential	65%	73%	64%	74%	73%
Black Residential	22%	19%	31%	22%	22%
Other Residential	7%	6%	3%	2%	3%
Hispanic Residential	6%	3%	2%	2%	2%
Total	100%	100%	100%	100%	100%
2000					
White Working	63%	61%	55%	65%	63%
Black Working	23%	23%	33%	22%	24%
Other Working	8%	9%	7%	7%	7%
Hispanic Working	6%	7%	5%	6%	6%
Total	100%	100%	100%	100%	100%
White Residential	59%	50%	64%	62%	61%
Black Residential	16%	15%	20%	26%	25%
Other Residential	13%	18%	9%	7%	8%
Hispanic Residential	12%	17%	7%	6%	6%
Total	100%	100%	100%	100%	100%
1990-2000					
White Working	29%	-20%	6%	45%	27%
Black Working	100%	18%	20%	95%	62%
Other Working	379%	204%	207%	385%	319%
Hispanic Working	389%	191%	192%	459%	348%
Total	58%	-1%	20%	70%	48%
White Residential	97%	-8%	29%	17%	18%
Black Residential	53%	9%	-15%	63%	58%
Other Residential	337%	320%	324%	305%	308%
Hispanic Residential	335%	592%	308%	332%	341%
Total	117%	33%	28%	39%	41%
Source: CTPP 1990, 2000					

A new dataset made available in the 2000 CTPP that was not part of the 1990 CTPP database is the length of U.S. residence. This is an interesting variable focusing on the percent of the population born in the U.S. and the percent that arrived in the U.S. since 1995 to expand the topic of cultural diversity in this research. Since country of origin data were not available in 1990, an attempt was made to construct the variable in a way to show if a pattern occurs between the two years of the study. The length of residence data from 2000 was divided into 5 categories, all population, native US, arrived since 1998, arrived between 1995 and 1998, and lastly arrived in 1994 or before. By pulling out the two categories of residents who arrived in the U.S. after 1995 and adding them together, explicit statements as to the level of diversity for each region of the Atlanta MSA can be made. Since there was no specific category that identified non-native population that arrived prior to 1990, there was no way to include such measurement to describe the level of diversity in 1990. Native U.S. citizens made up 87 to 88 percent of both the total 2000 employed and residential MSA populations (Table 4.7). Including the population that had arrived since 1995 to try and capture patterns in where new immigrants were choosing to live and work showed very small amounts of new immigrant populations overall in the Atlanta area. While the percentages of new immigrant populations were small for the Atlanta region, it is worth noting that edge cities and suburban employment centers showed the highest percentage of foreign born residents arriving since 1995 at eight percent and nine percent, with only three percent of residents in the MSA having arrived in the US since 1995. These percentages could create a case against the lack of racial diversity in edge cities seeing, how edge cities also

have a lower percentage of native US residents (79%) than does the MSA as a whole (Figure 4.12). Additionally, it is evident that the developmental patterns of edge cities and suburban employment centers have an appeal to immigrant populations and are influential in the residential and employment choices made by new immigrant populations.

Table 4.7 2000 Native and Immigrant Populations

2000 Native & Immigrant Populations as a Percent of the 2000 Population in each Region	Edge Cities	Suburban Employment Centers	Urban Employment Centers	Edgeless (all other)	MSA
Native U.S. Residential	79%	77%	89%	89%	88%
Arrived in the U.S. after 1995 (Residential)	8%	9%	4%	2%	3%
Native U.S. Working	85%	84%	87%	87%	87%
Arrived in the U.S. after 1995 (Employed)	5%	5%	4%	4%	4%
Source: CTPP 2000					

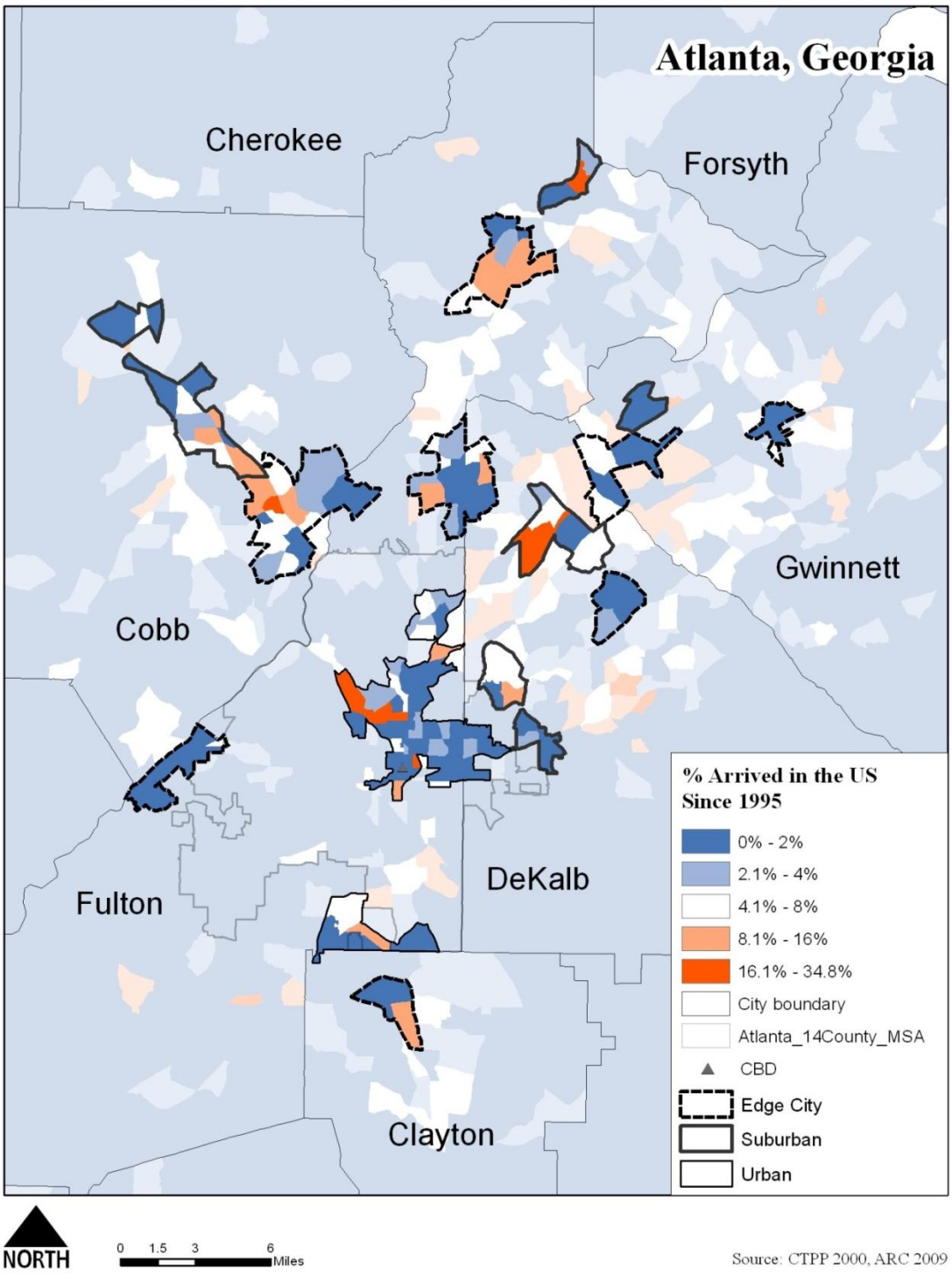

Figure 4.7 2000 Percent Employed Residential New Immigrant Population

4.4 Jobs-Housing Balance and Mismatch in Centers, Edge Cities and Edgeless Cities: 1990 to 2000

The jobs-to-housing ratio is a very basic measurement of the number of jobs in one area divided into the number of housing units in the same area, a value of 1 would mean that there is one job for every housing unit in that area. When looking at the job housing ratio and its change over time, it is evident that while the entire MSA and even the edgeless developments have a relatively balanced job to housing ratio, the case in employment centers and edge cities is drastically different. Examining Figure 4.8, it is clear that there is a high level of employment concentration in edge cities, urban and suburban employment centers. This is likely a result of the methods for identifying these areas. The job housing ratio decreased for edge cities, suburban and urban employment centers; however, in both years there was high number of jobs to housing units. In 1990, edge cities had the highest number of jobs per housing unit by a large margin. In 2000, the jobs housing balance in edge cities did show some signs of stabilization and fell below the ratio in urban employment centers. The decrease in the edge city ratio could possibly be due to a concentrated effort to develop large housing tracts in and around areas that displayed the potential for employment growth from 1990 to 2000. In urban employment centers, while the jobs to housing ratio did decrease by 2000, it is the highest for the entire MSA at 6.5 jobs per housing unit. The decrease of the jobs to housing ratio in suburban employment centers could be due to the overall decrease in employment in this region. The jobs housing balance essentially indicates that there is a common lack of overall housing units available in the areas that I have identified as edge

cites, urban and suburban employment centers. Future efforts aimed at incorporating more residential developments are needed to both improve the jobs to housing balance, increase housing and population density and appeal to the newer, more environmentally conscious and sustainably minded metropolitan workforce.

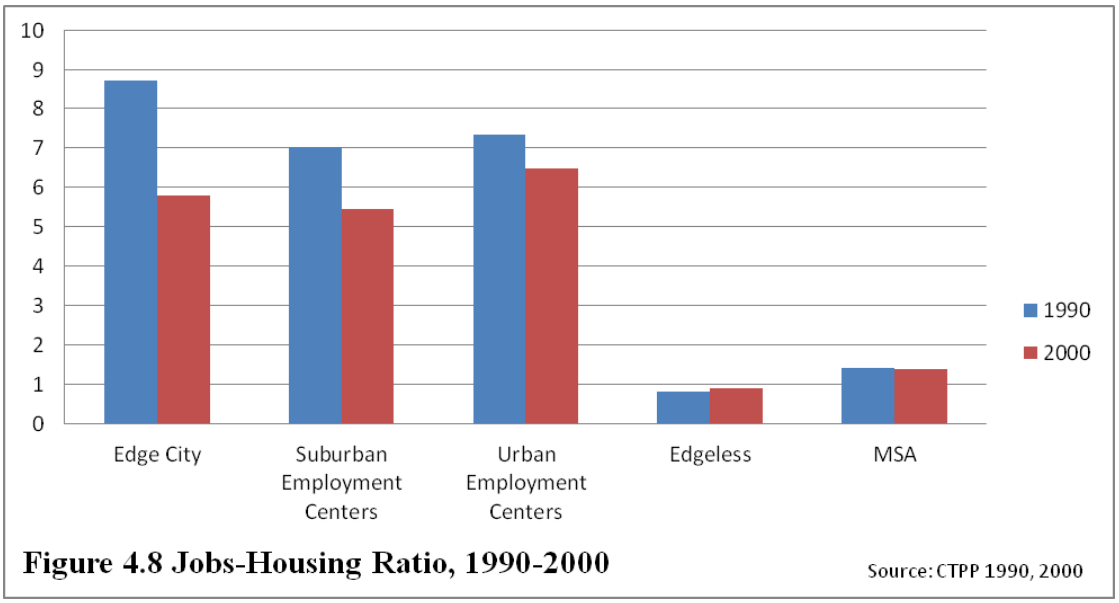

Figure 4.8 Jobs-Housing Ratio, 1990-2000

Source: CTPP 1990, 2000

4.4.1 Commuting Characteristics and Job-Housing Balance/Mismatch

Commute times calculated on average for workers and residents in each area were used to address edge city criticisms, including an indicator of the jobs-housing balance. For the entire Atlanta area, the average travel time was 26.15 minutes for residents and 24.59 minutes for employees in 1990.

In 1990, the highest average travel time for residents of 26.5 minutes occurred in edgeless developments, close to the average of the MSA, but longer than the travel times for residents in both edge cities and suburban employment centers. Suburban employment centers had the lowest average residential commuting times in 1990 at 20.5 minutes. For employees, the highest average commuting time of 25.5 minutes in suburban employment centers was only slightly higher than in urban employment centers and edgeless developments. Edge cities have the lowest average employee commuting times in 1990, at 22 minutes. Likely causes for this trend could relate to the design of edge cities incorporating commercial establishments adjacent to large housing subdivision tracts. The possibility of edge cities, urban and suburban employment centers being better served by public transportation than edgeless developments could contribute to the lower commute times for edge cities, urban and suburban employment center. With fewer commuters on the road, less congestion may result in shorter commutes, which is a reasonable explanation for the commute times among urban employment centers in 1990 also (Figures 4.9 and 4.10).

In 2000, for the entire Atlanta area, the average travel time was 30-31 minutes for residents and employees. The average travel time for employees in urban employment centers was 36.6, the highest in 2000 and an increase of over 10 minutes from 1990. Commuting times for employees of edge cities had the largest increase of 13.5 minutes from 1990 to 2000. The high commuting times of edgeless residents in 2000 indicates that housing and job locations must be increasing in distance from each other, since it has been shown that traffic congestion is a non-issues in edgeless areas (Lang 2003). Congestion-related one-way commuting times are expected among employees in the relatively more dense employment clusters when compared to longer one way commuting times evident among residents of edgeless cities, where the distance between work and home is greater than anywhere else in the region. Commuting times for both employees and residents increased across the board for all areas in 2000.

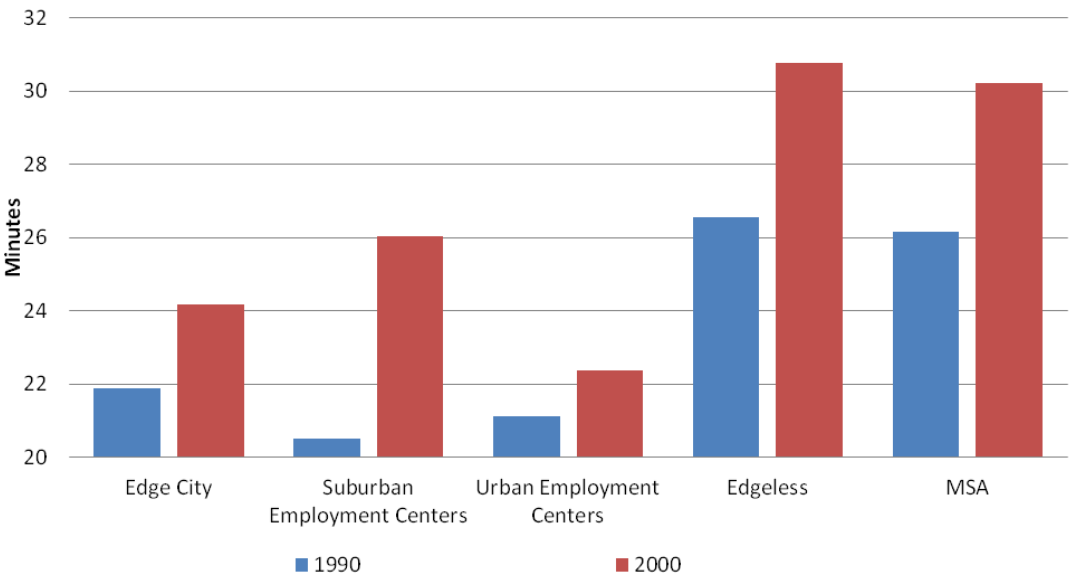

Figure 4.9 Mean One-way Residential Commuting Times, 1990-2000

Source: CTPP 1990, 2000

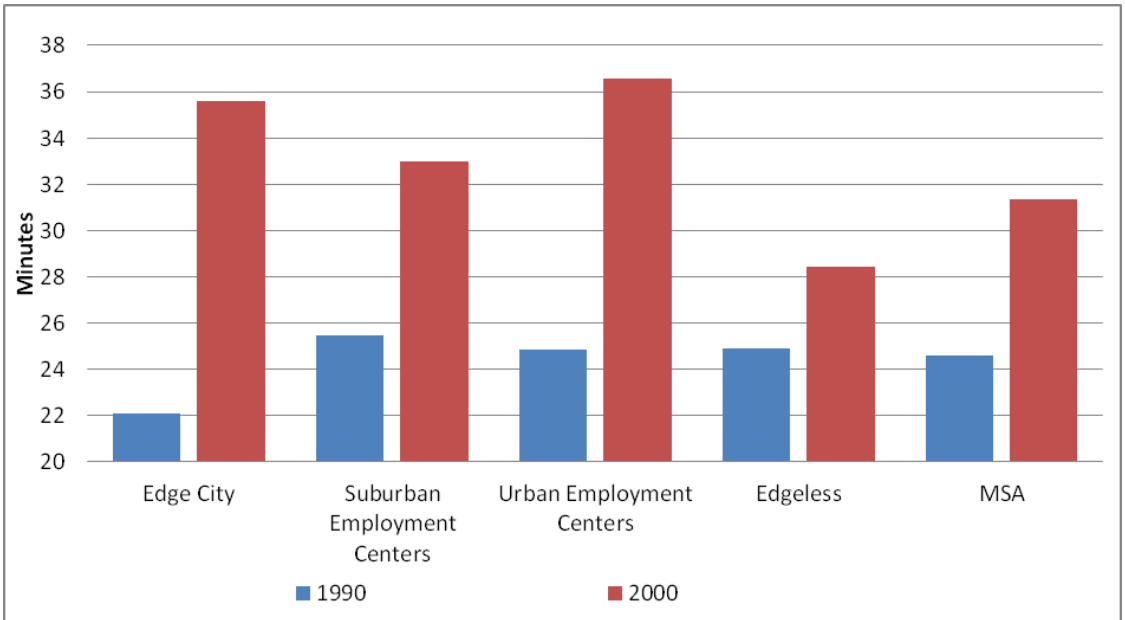

Figure 4.10 Mean One-way Employee Commuting Times, 1990-2000

Source: CTPP 1990, 2000

4.4.2 Income Potential of Employees and Residents

The average earnings of workers and residents in the entire MSA was roughly $27,500 in 1990. Looking at earnings in 1990 for the regions of this study (Figure 4.11), it is interesting to note that only in edgeless developments do residents earn more than employees, while in all other categories employees earn more than residents by a large margin. I would argue that edge city, urban and suburban employment center employees are not living in the same places where they work. In contrast, the residents of suburban employment centers, having the lowest average earnings, are likely to be the most spatially displaced. Another interesting argument displayed by this data is the affordability of residential options in edge cities for the employees working there based on the earnings of residents living in edge cities. This is also evident in suburban and urban employment centers where the income of residents is lower than the income of employees in these regions. The average earnings of workers in the entire MSA was at $40,075 in 2000, while the average earnings of residents was very similar to that of employees at $40,500. Urban employment centers and edge cities had the largest increases among residential and employee incomes from 1990 to 2000. This again, displays a shared demographic trend among the urban core and edge cities. As in 1990, employees earn more than residents in edge cities, urban and suburban employment centers. For urban employment centers residential earnings are only slightly less than that of employees which shows a potential improvement in the mismatch of earnings between employees and residents of the same area. Interestingly, in 1990, the highest residential

earnings can be found in edge cities and urban employment centers. This could indicate a potential growth of residential options aimed at the employees of these regions. Employee earnings being greater than residential earnings in both 1990 and 2000 edge cities and suburban employment centers displays a potential mismatch between the employment opportunities for the residents of these areas, and the affordability of residential options near lower wage employment options. This would coincide with past research that emphasizes an overall spatial mismatch between jobs and housing in the Atlanta region (Beauregard 1995, Sultana 2002, Weitz 2003) (Figure 4.12). A positive perspective of the increasing employee and residential incomes of both edge cities and urban employment centers lies in the successful economic growth associated with rising incomes and growing residential populations, a potential indicator of rising acceptance of edge cities in unison with a trend towards returning to the urban core.

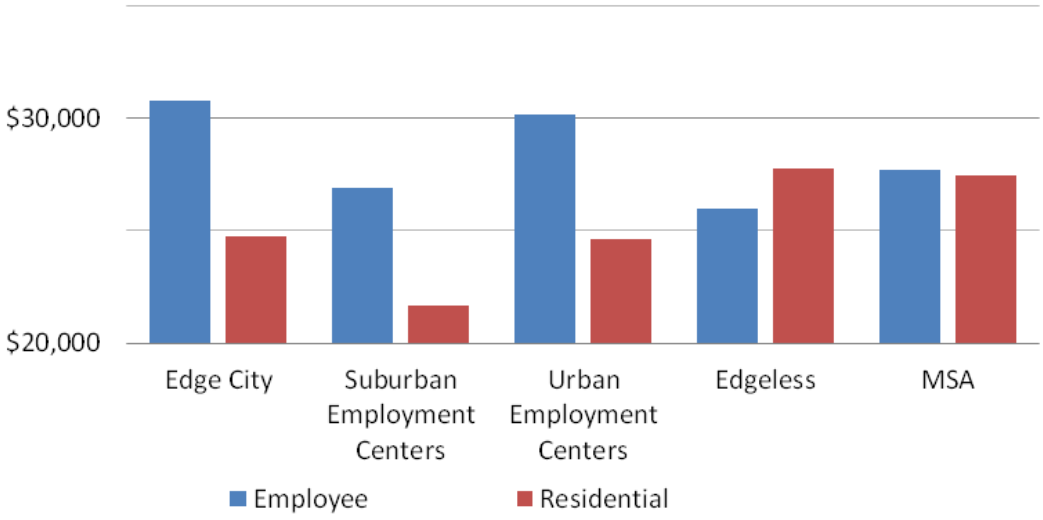

Figure 4.11 Mean Earnings, 1990

Source: CTPP 1990

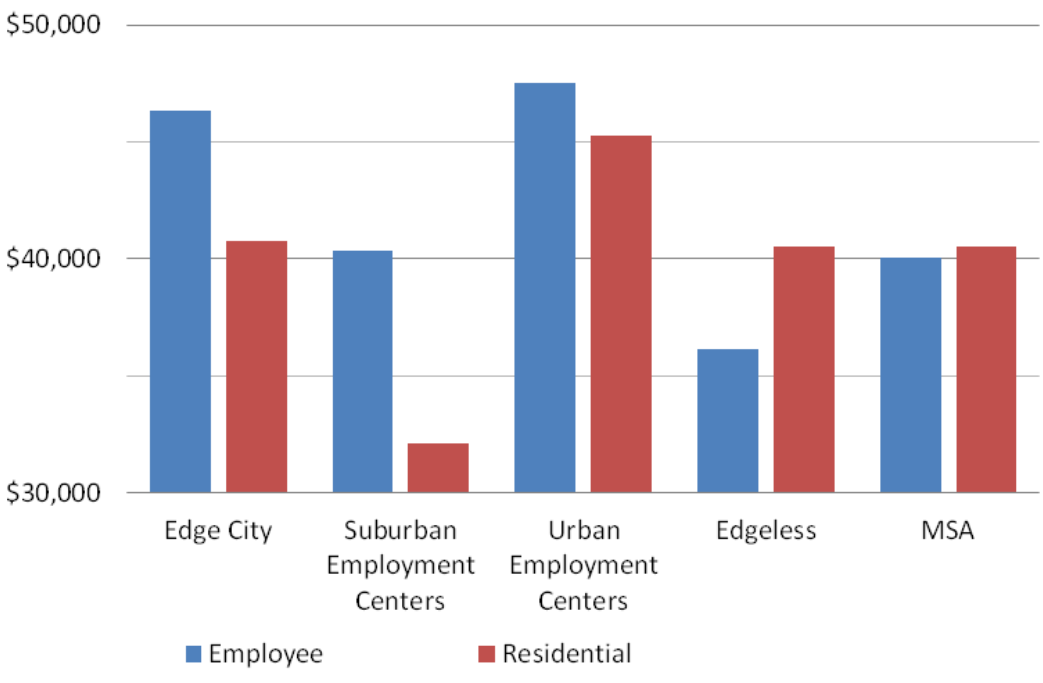

Figure 4.12 Mean Earnings, 2000

Source: CTPP 2000

4.5 New Urbanism and Smart Growth in Centers, Edge Cities and Edgeless Cities: 1990 to 2000

4.5.1 Density

In 1990, there was a total of 1,001,177 housing units, or .39 housing units per acre in the MSA. There is little deviation from the total housing density for each of the sub-regions, with the exception of urban employment centers where a total of 43,466 housing units results in a housing density of 2.8 units per acre. As a percentage of the total housing, edgeless developments account for 91 percent of all the housing in Atlanta; the next largest percentage of total housing is found in the urban employment centers (4.3%). Housing density in 2000 for the Atlanta MSA was at .51 units per acre, with a total of 1,458,992 housing units. Overall, in the entire Atlanta MSA, housing density increased showing an increase in the number of housing units. Urban employment centers in 2000 had the highest density at roughly 3.9 houses per acre. Edge cities in 2000 had the third largest share of housing (3.4%), behind edgeless developments, containing 90 percent of the total, and urban employment centers with 3.9 percent of all the housing in 2000. Urban employment centers had the highest housing density at 3.3 housing units per acre. Also, in 2000, it is interesting to note that edge cities and urban employment centers have a similar number of housing units, with urban employment centers having fewer than 8,000 more housing units than edge cities. A similarity between the two in number of housing units, however, does not translate to the housing density. This may indicate that in edge cities housing is added as the land area of edge cities expands, where in contrast

in urban employment centers any new housing is likely to be in the form of an infill development due to space limitations. (Figures 4.14 and 4.15)

Table 4.8 Housing Units and Density, 1990 and 2000

1990	Housing Units	Housing Density	Percent of Total
EDGE	21,723	1.02	2.17%
Suburban Employment Centers	24,264	1.23	2.42%
Urban Employment Centers	43,466	2.82	4.34%
EDGELESS	911,724	0.36	91.07%
Total	1,001,177	0.39	
2000	Housing Units	Housing Density	Percent of Total
EDGE	49,594	1.50	3.40%
Suburban Employment Centers	29,800	1.63	2.04%
Urban Employment Centers	57,244	3.33	3.92%
EDGELESS	1,322,354	0.47	90.63%
Total	1,458,992	0.51	
Source: CTPP 1990, 2000			

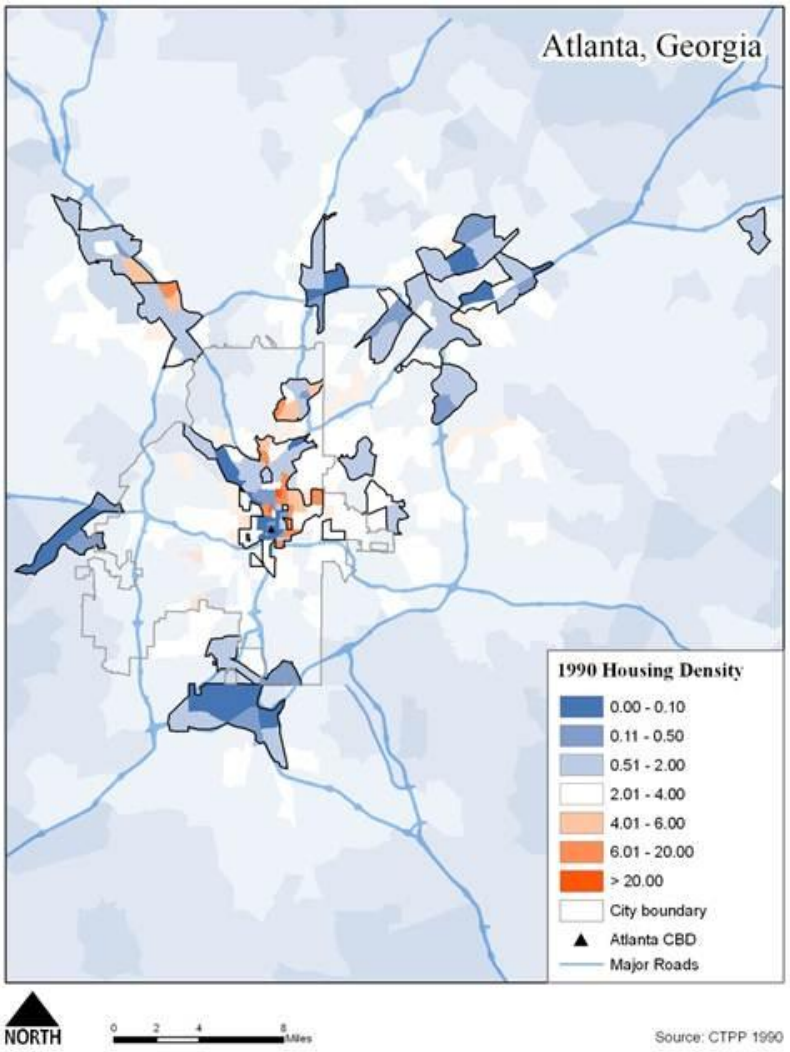

Figure 4.13 Housing Density in Atlanta MSA, 1990

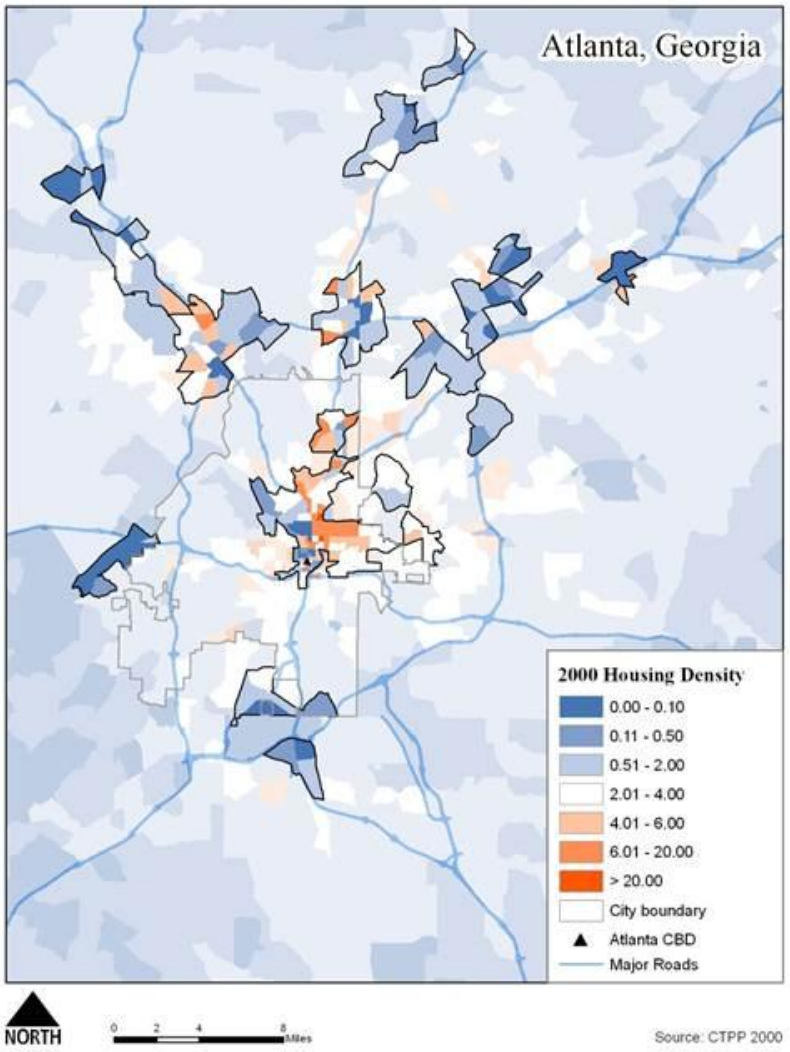

Figure 4.14 Housing Density in Atlanta MSA, 2000

4.5.2 Transportation Infrastructure and Characteristics

Transportation characteristics of workers are evaluated based on vehicle density per capita (vehicles per 1000 people) and the amount of the population using alternative modes of transport or non-car workers. A common measurement of a region's reliance on personal transportation is the vehicles per capita (Kahn, Morris 2009, Bullard 1999), in this case, vehicles per 1,000 people. These transportation characteristics were used to address a number of aspects of edge city development and criticisms, including the influence of public transportation use by both employees and residents. From CTPP data indicating the mode of transport to work, all non-automobile modes of transportation were combined into one alternative mode of transportation category, which could include public transportation, walking, biking, motorcycle, or even ferry. By combining the data in this way, it provides a significant number for analysis in comparison to looking at the number of workers that only ride a bicycle to work, or that only walk, in which case the numbers would be hidden among the much larger percentage of the population that do not use those modes of transportation. To evaluate the level of alternative and active transportation, the number of non-car commuters for each area was investigated (Figure 4.16, 4.17). In 1990, seven percent of the working and four percent of the residential Atlanta population commuted using alternative modes of transportation. Based on the aggregated number of vehicles, there were 835 vehicles per 1,000 workers in 1990. Looking at the percentage of the population that is using alternative and active modes of transportation, urban employment centers by far have the highest percentages of the both the residential and employee populations using alternative modes of transportation in

both 1990 and 2000. This finding coincides with the common idea that at the city center is an abundance of active public transportation use (Garreau 1991, Beauregard 1995, Wheeler 2004). Edgeless cities have the lowest percentage of the residential population in both 1990 and 2000 using alternative modes of transportation. This would be expected due to the difficulties of providing public transportation service to this area and the distances between homes and workplaces.

The highest vehicle per capita measurement among employees in both 1990 and 2000 was in the edge cities. However, urban employment centers were the only region that had an increase in vehicles per capita in the entire Atlanta region from 1990 to 2000, with 799 vehicles per 1,000 employees in 2000, an increase of almost twenty vehicles per 1,000 employees. In urban employment centers, there were 780 vehicles per 1,000 workers, the lowest of all sub-regions in 1990. The next lowest vehicles per capita were in edgeless developments with 834 vehicles per 1,000 people. This was an interesting result since they represent opposing trends in suburban development, and considering the length of commute between home and work in edgeless developments. Given the literature describing how the developmental patters of both edge cities and suburban employment centers contain auto dependent characteristics (Garreau 1991, Southworth 1997, Sultana 2005, Swope 2009), the high number of vehicles per capita in these regions is not surprising (Figure 4.15).

For the year 2000, in the Atlanta MSA, six percent of the total working population and three percent of the residential population used alternative modes of transportation in

2000. Based on the aggregated number of vehicles in 2000, there were 830 vehicles per 1,000 employees for the entire Atlanta region. Among edge cities, an increase in the percentage of employees using alternative modes of transport stands out as the only increase in Figure 4.16. Reductions in both employees and residents using alternative modes of transportation were observed for edgeless job sprawl developments and the Atlanta region as a whole from 1990 to 2000. The observation that in 2000, residents of urban employment centers commute the most using non-car modes of transportation is not surprising when looking at accessibility to public transportation in central business districts (MARTA). It is also worth noting that urban employment centers, which have the highest percentage of the population using alternative transportation, also have the lowest vehicles per capita among both employees and residents. The fact that edge city employees are the population using the least amount of alternative transportation options creates an interesting finding for this research. If edge cities were to show signs of embracing smart urbanism practices, one would expect to see larger percentages of both employee and especially residents using alternative modes of transportation (Figure 4.16 and 4.17).

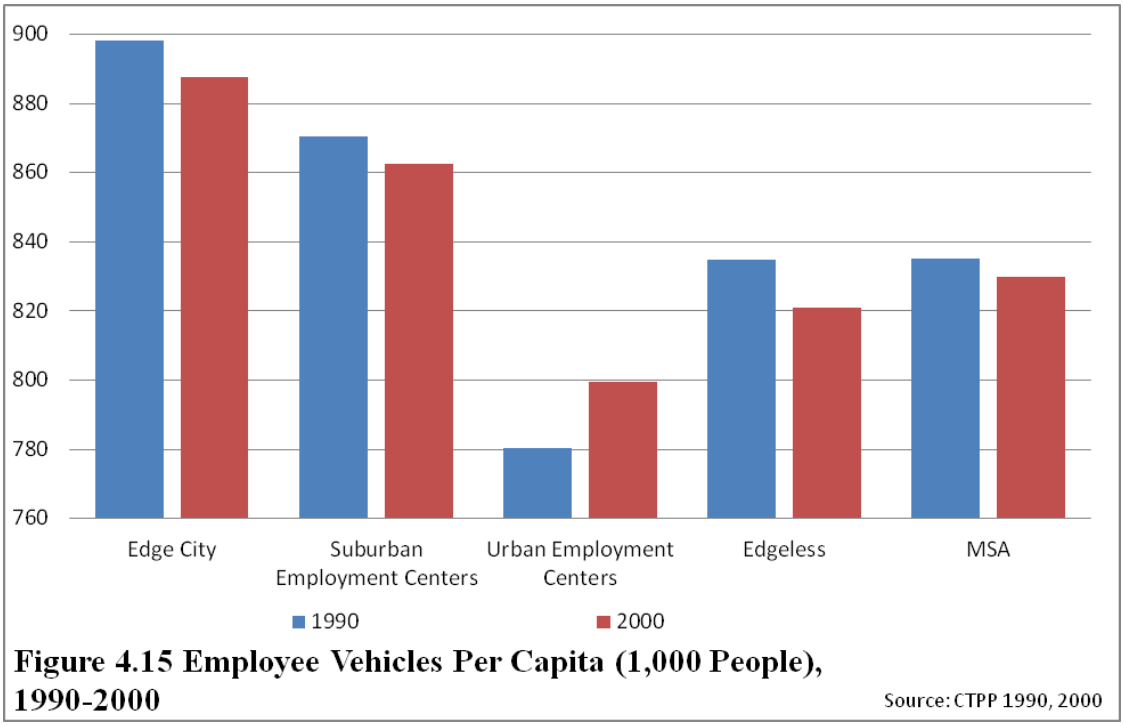

Figure 4.15 Employee Vehicles Per Capita (1,000 People), 1990-2000

Source: CTPP 1990, 2000

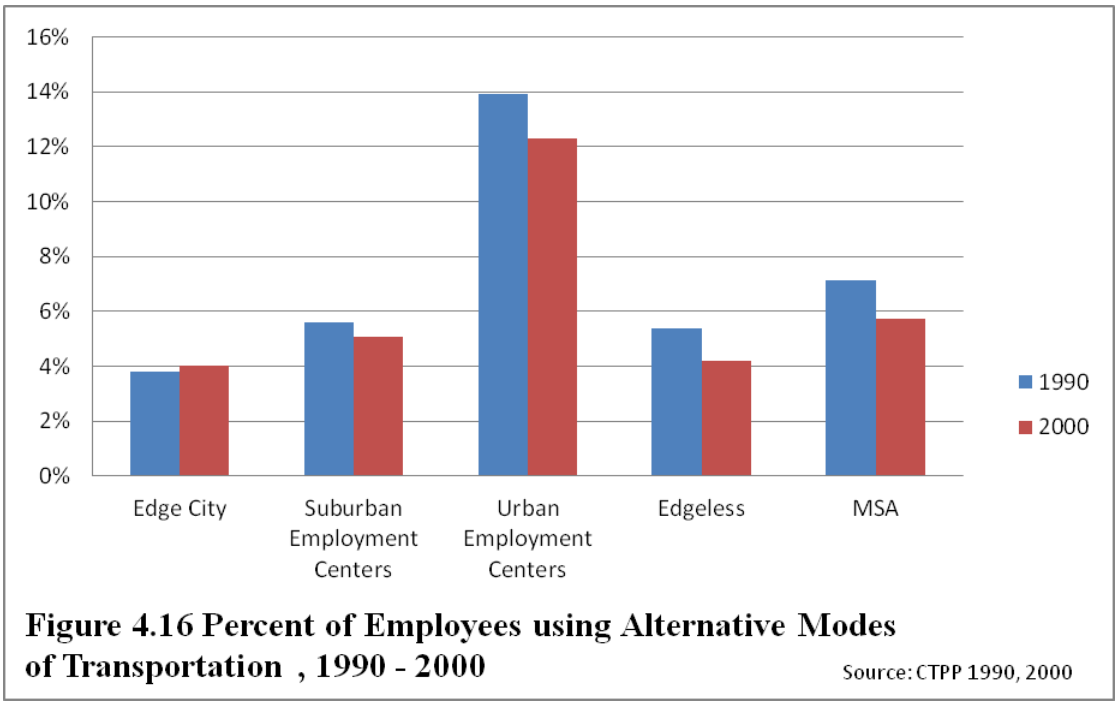

Figure 4.16 Percent of Employees using Alternative Modes of Transportation , 1990 - 2000

Source: CTPP 1990, 2000

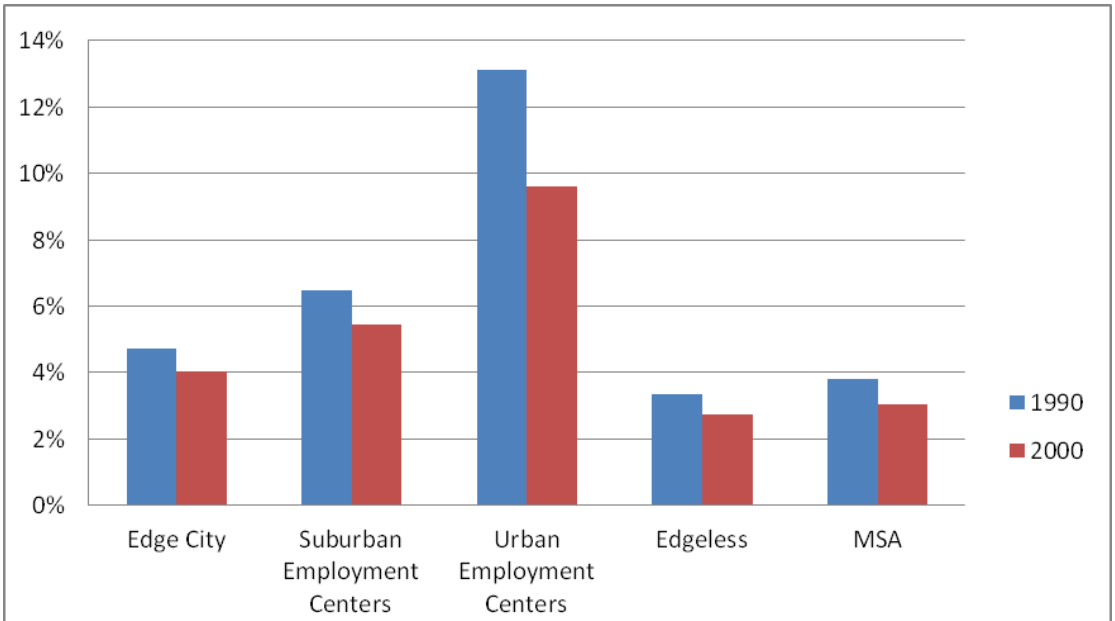

Figure 4.17 Percent of Residents using Alternative Modes of Transportation, 1990 - 2000

Source: CTPP 1990, 2000

Are edge cities efficient in environmental and economic terms? This is the question that was under investigation when the mode of transport and the locations of MARTA rail stations was incorporated into the study. Using the percentage of commuters that use public transportation, bus, rail, subway, ferry, bicycle, walk, motorcycle, or other alternative modes of transportation (Figures 4.18 and 4.19), a generalization is possible about the level of infrastructure available to support these modes of transportation for residents and employees. While the area that has the largest percentage of non-car commuting employees in 1990 and 2000 is edgeless cities, the percentage does become more evenly distributed in 2000. Moreover, edge cities show growth in non-car commuting employees from 1990 to 2000.

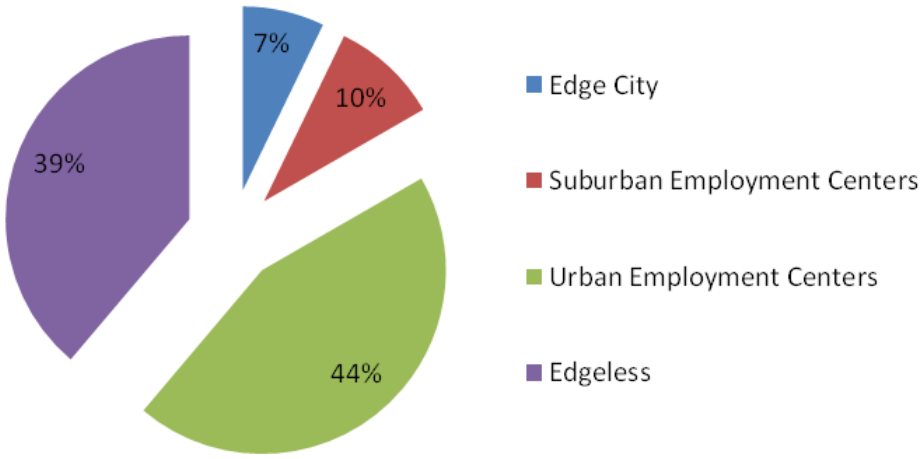

Figure 4.18 Percent of Non-Car Commuters, 1990

Source: CTPP 1990

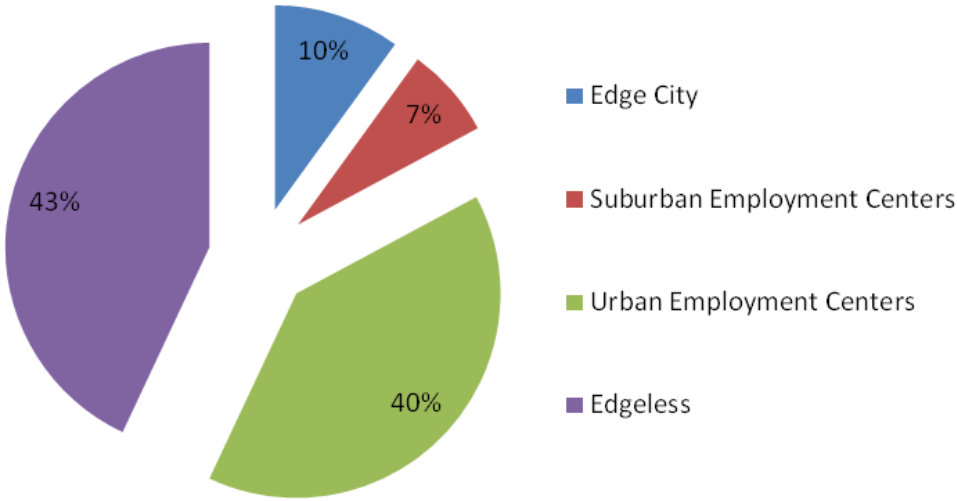

Figure 4.19 Percent of Non-Car Commuters, 2000

Source: CTPP 2000

From 1990 to 2000, there were nine new MARTA stations built outside the city boundary to serve the suburban populations. Of these nine new stations, four of them are located either within or adjacent to edge cities identified in 2000, including the Dunwoody, Medical Center, Sandy Springs and North Springs station, all serving the Perimeter edge city. Of the other five MARTA stations that were constructed from 1990 to 2000, one happens to be located in the Doraville area that was an edge city in 1990, but in 2000, is only an employment center. In 1990, six of the eight MARTA stations outside of the city boundary were co-located with an employment center or edge city, these were the Decatur employment center, Doraville edge city, and the Hartsfield Airport areas (Figures 4.20 and 4.21). It is evident by the following map that public transportation and edge city and suburban employment center developments do occur in the same places. The map, however, is not a sufficient source of evidence as to whether the MARTA stations influenced the development of the employment centers and edge cities, or if it is the other way around and that the employment centers influenced the development of the MARTA stations. Looking at the new north line of the MARTA near the Perimeter Center edge city, it would seem as if the MARTA station is responsible for the shift of the 1990 Perimeter Center edge city southward to concentrate around the station.

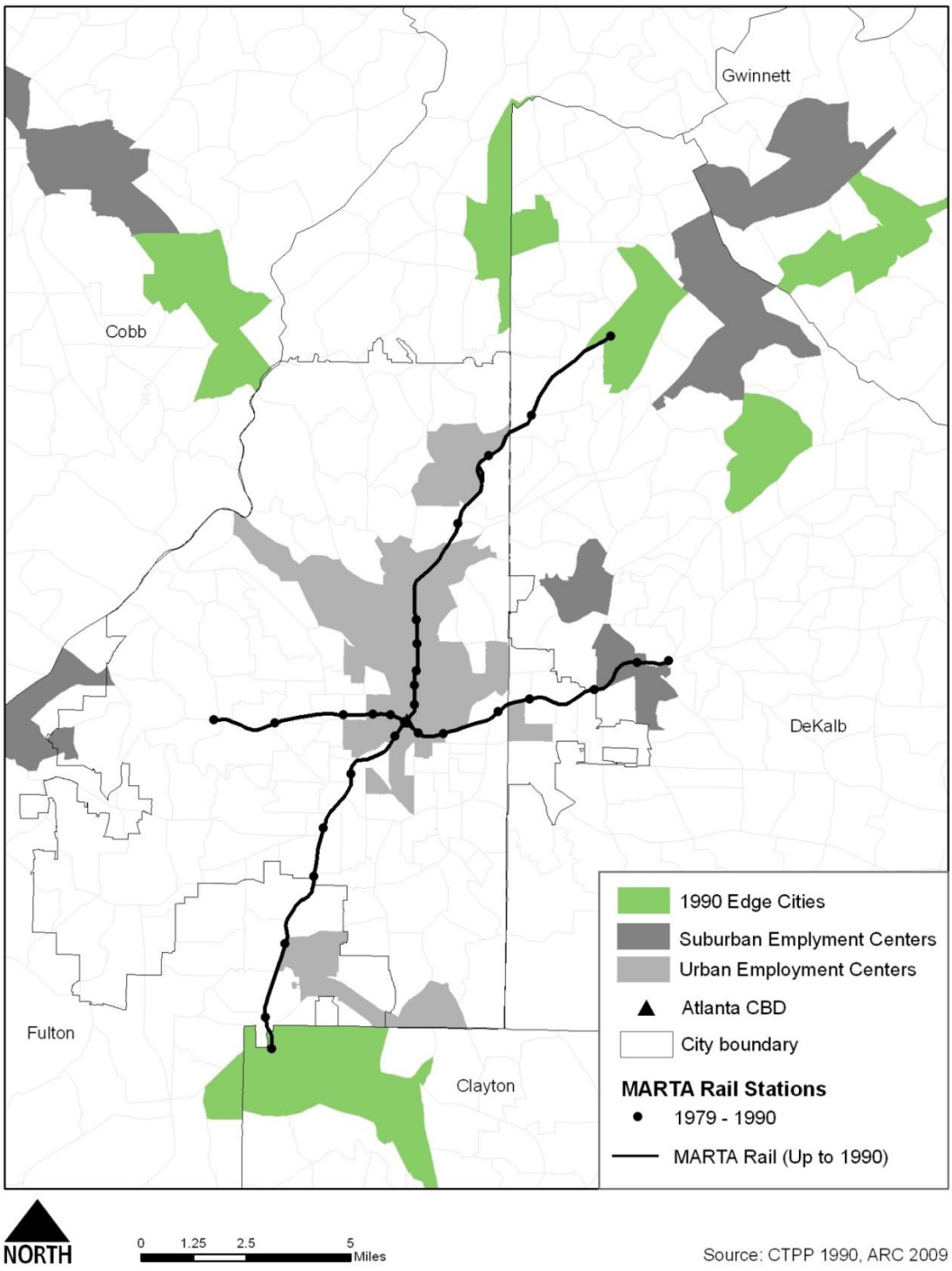

Figure 4.20 1990 MARTA Stations and 1990 Employment Centers and Edge Cities

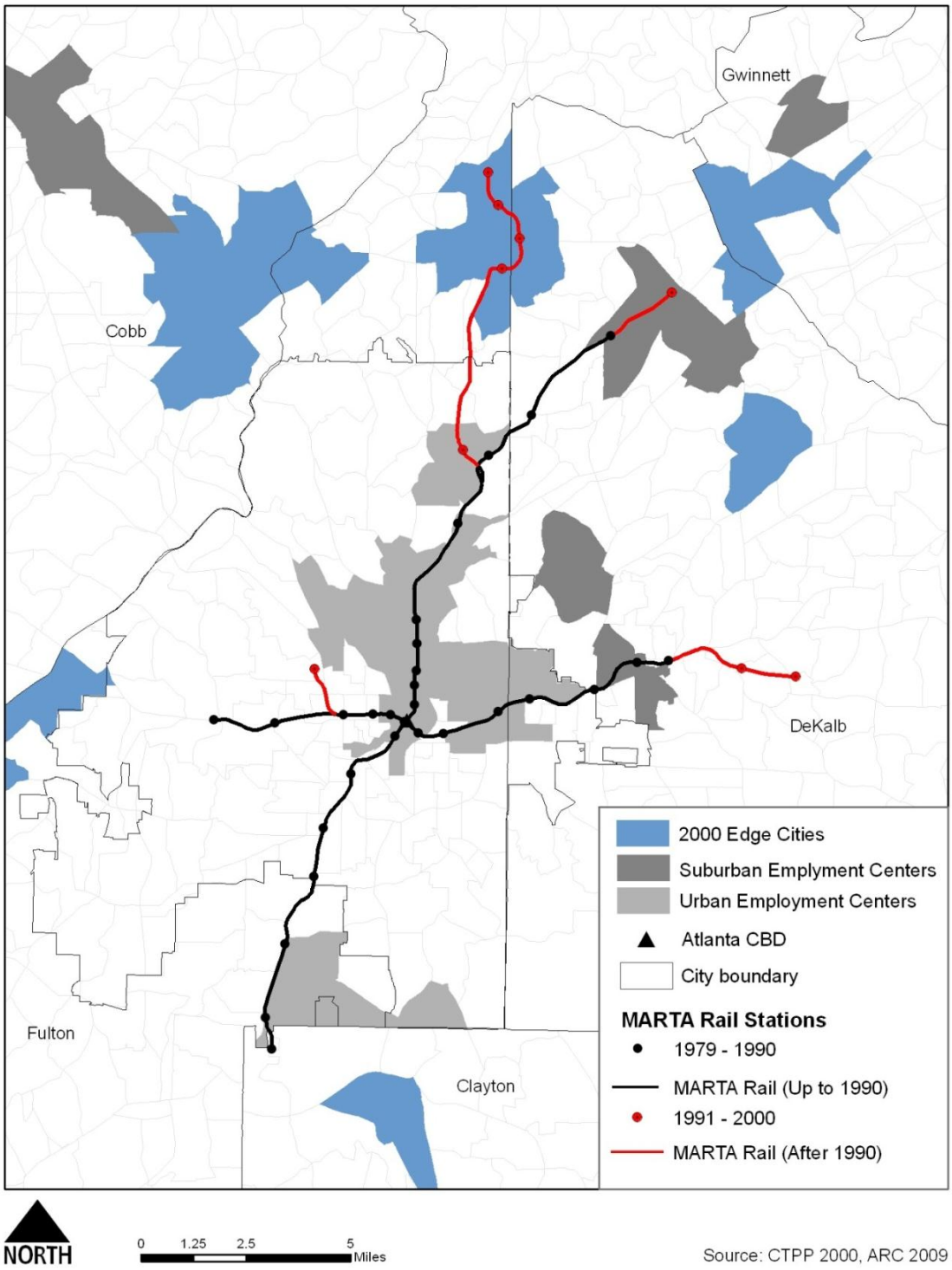

Figure 4.21 2000 MARTA Stations and 2000 Employment Centers and Edge Cities

Additional data exclusive to 2000 that provides an alternative perspective on the aspect of alternative transportation is the number of families with one car or less (Figure 4.22). Past research shows that greater public transportation supply, in addition to higher population densities, can reduce auto dependence (Kahn and Morris 2009). Of particular importance to this research is the idea that edge city developments are favored for their accommodation of the automobile by allowing for an overly generous supply of parking (Litman 2011, Garreau 1991). One clear relationship is that among urban employment center residents, there is the highest percentage of non-car commuters combined with the highest percentage of families with fewer than two cars in 2000. Along with urban employment centers, residents in edge cities and suburban employment centers also have over 30 percent of families with fewer than two cars. It was an expectation going into this study that the measurement of families having fewer than two cars would be an indicator of both the available transportation infrastructure in terms of parking and also the use of alternative transportation. Based on the increase in the percentage of families with fewer than two cars in edge cities, suburban and urban employment centers, it would appear as if the populations of these areas were adapting to the use of alternative transportation options, as well as having some adaptability towards new developments that minimize the emphasis on parking space. An important measurement that factors heavily into personal vehicle ownership is income; however, it is also important to note that past research shows increasing parking availability also increases housing and rent cost, often excluding lower income populations. In 2000, urban employment center employees and residents had the highest earnings among the different regions in this

study, yet they also had the highest percentage of residential families using fewer than two automobiles. An explanation for this could be due to the availability of public transport options in the urban employment centers, reducing reliance on the personal automobile. The next highest percentage of residential families using fewer than two cars occurs in suburban employment centers, where in contrast to urban employment centers, mean residential earnings in 2000 were the lowest.

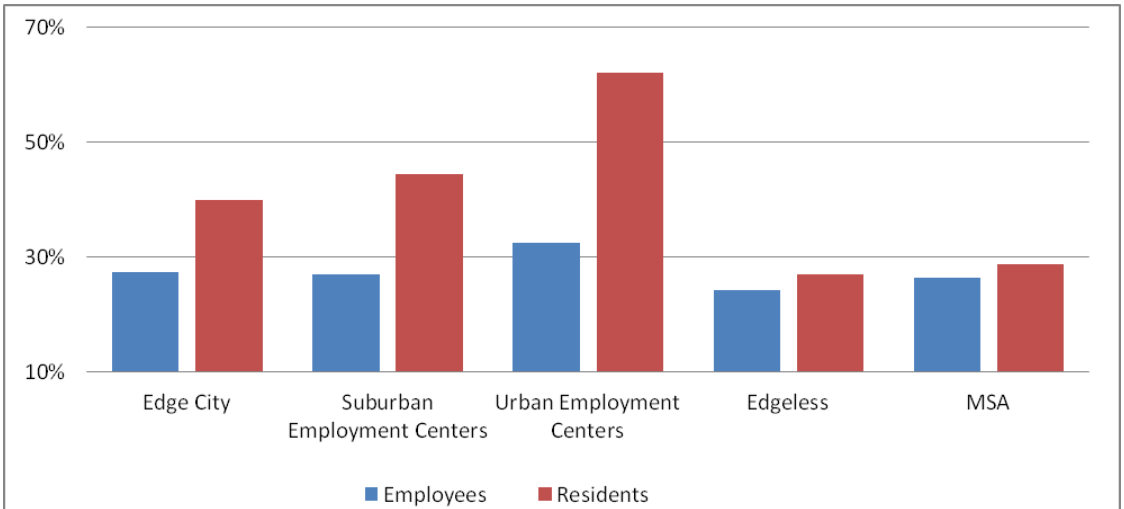

Figure 4.22 Percent of Families Using Fewer than Two Cars, 2000

Source: CTPP 2000

CHAPTER V

SUMMARY, DISCUSSION AND CONCLUSION

It is clear that edge cities have yet to become the "crucible" of urban America, as Garreau advocated. What is certain is that edge cities are part of a dynamic process that parallels that of the more traditional urban core. With the onset of this research aimed at determining accurate geographic locations and boundaries of edge cities, using employment densities and characteristics it was possible to precisely differentiate between areas that fit into the typology of edge cities, urban and suburban employment centers. Additionally, comparing edge cities to other areas and measuring the change in edge cities to sustain future growth and maintain appeal is a critical finding of this research. The initial focus of using the combination of detailed employment and population characteristics data to successfully identify edge cities created an entirely new perspective of edge city research that has never been done before.

Variables often used to identify developmental trends include racial diversity, jobs-housing balance, commuting times, income, density and transportation use. These were also used in this study to explore edge cities. Defining edge cities by the prevalence of certain characteristics helped establish an identity and path for future development. Analysis over the period of a decade, from 1990 to 2000, provides conclusive

geographical evidence pointing towards the fact that edge cities are both growing and disappearing at the same time. The increase in the number of edge cities from six to eight between 1990 and 2000 includes four completely new edge cities, and a loss of two. Two of the four new edge cities came out of nowhere, not even existing as an employment center in 1990. These were the Roswell/Alpharetta area and the Gwinnet Place Mall area. This was a particularly interesting finding because these two new edge cities were at an extreme distance away from the city center relative to most other employment clusters in 2000, and most likely represent areas that were developed as edge cities, as opposed to the other six areas that either were edge cities in 1990 or transitioned from employment center to edge city. A difficulty exists in forecasting where new edge city growth will occur given the unpredictability of both new edge city growth and loss, but it does appear that potential edge city cultivation in the Peachtree Corners, Towne Center at Cobb and North Alpharetta areas seems logical.

Revealing what potential developmental trends exist for the Atlanta region by focusing on identifying newly established edge city developments are a large contribution of this research. While external forces such as commercial land prices and tax incentives could influence shifts in edge city development and metropolitan population patterns as described in past research (Henderson, Mitra 1996, Scheer, Petkov 1998, McKee 2001), it is the long term sustainability of these places that determines their success. Growth and development of Atlanta's edge cities in particular seems to be lacking in comparison to urban revitalization and continued office sprawl. The 76 percent growth in edgeless employment shows the influence that low density sprawl type areas have over the

employee and employer location choices. Edge cities are, however, second in the running, which emphasizes the importance of the two contrasting concepts in suburban development. Looking to the future with an awareness of what the results of this study might show when conducted using 2010 TAZ data, some speculation as to where edge cities may develop can be provided. The 2010 Atlanta, Georgia MSA should show the expansion of the employment centers at North Alpharetta and North Druid Hills. In addition, the edge city of I85/285 Norcross will likely merge with Peachtree corners to form one larger employment center, while the Doraville employment center will likely become an edge city due to the MARTA station there. Expansion will likely occur at the edge cities at Roswell/Alpharetta, Gwinnet Place Mall, and Northlake Mall. New edge cities could include the Towne Center at Cobb and the area around the Mall of Georgia, or even around the city of Gainesville, Georgia at nearly 50 miles away from the CBD.

Many of the smart urbanism concepts that are designed to create density and diversity seem to have revived the appeal of moving back into the urban employment centers based on the high numbers of alternative transportation uses, low residential commuting times and high housing density, combined with an increase in the working population among all races in 2000. Fortunately, there are a number of similarities between the urban core and edge cities established as a result of this study. For example, the level of diversity among edge cities and urban employment centers is very similar. When looking at the immigrant population, edge cities contain a larger percentage compared to urban employment centers, displaying a trend among new immigrants towards residing in edge cites rather than urban employment centers, potentially as a

result of diverse employment opportunities. Another variable that is very similar among edge cities and urban employment centers is the incomes of residents and employees in these areas. When looking at the incomes of employees in these two areas, it is important to reconsider the criterion that was used to identify edge cities. Using an occupation/industry specific location quotient cutoff is essentially showing us what employees of these industries are earning.

Data related to the use of public transportation and transportation infrastructure was used to explore the influence that these factors have on edge city development. Significant growth of edge cities in ways that ignore any jurisdictional or political identification are potentially a result of employment clustering around transportation interchanges as in the case of the Cumberland Mall area(I-75 and I-285), Perimeter Center (Hwy400 and I-285) and the I85/285 area near Norcross. Also, the development of the Perimeter Center seems to have been in conjunction with the development of four new MARTA rail stations all in the same edge city location. Reasons behind the loss of some edge cities near rail stations are unclear, particularly since new light rail stations were added between 1990 and 2000. New light rail stations constructed since 1990 elsewhere in the city seem to have influenced the development of the I-85/285 and Perimeter Center edge city (Figures 4.20 and 4.21).

Measuring smart urbanism by way of commuting, transportation use and diversity provided mixed results. This, however, is not disconcerting. There has been little such research that aims to explore how to gauge whether smart urbanism has been

implemented to revitalize any area of the suburban landscape. One relationship that can be seen is that as the percentage of residential families using fewer than two cars rises, so too does the percentage of the residential population using non-car modes of transportation. This is an expected result given that having fewer automobiles would make one more reliant on non-car modes of transportation. As seen earlier, it is in the urban employment centers where these percentages are the highest.

Interesting relationships between the different variables used in this study also include the connection between mean commuting times of employees in 2000 and the jobs-housing balance. As the number of jobs outnumbers the available housing units, the mean travel time for employees commuting to those areas also increases. In 2000, the highest jobs-housing imbalance of 6.5 in urban employment centers also had a mean one way travel time of 36.58 minutes for employees. Edgeless developments and office sprawl at the other end of the spectrum had the lowest number of jobs to housing units in 2000 (0.9) combined with the lowest mean one-way travel time among employees at 28.41 minutes.

While the edge city concept may have faded in some circles, concentrations of office-based employment will continue to be developed as long as large corporations or financial firms are looking to draw employees from the traditional urban core where traffic congestion is high and housing options are limited. Most important will be how both the housing and transportation needs of future employees and residents will change and whether the efforts of smart urbanism will prove to be sustainable. This research

provides an understanding of where office-based developments have the largest impact on both urban and suburban regions. Categories used in this study to define the economic landscape help to develop criteria for what should be considered an urban employment center and where to draw the line between suburban employment center and edge city. What constitutes an edge city in terms of actual employment numbers is something that had not been addressed in prior research. Nonetheless, this has been shown to be a valuable indicator of edge city presence. This is an alternative method to the more common use of office space, a method which in the author's opinion has limitations that tend to result in either more spread out and undefined areas identified as edge cities, or in edge cities that actually function as part of the urban core.

These findings, although different from what Garreau points out, are showing how edge cities are adapting to mainstream criticisms of 1990 edge city shortfalls. It would be interesting to see this research applied to cities elsewhere in the country. The use of the Atlanta, Georgia MSA in this study provided a very straight forward study area for comparing edge cities to edgeless cities, given the mono-centricity of the downtown. Including large cities from different regions across the U.S. would be interesting as well as providing dynamic challenges and outcomes to how the clash over land among edge and edgeless cities is perceived. Each region and city has some form of growth management system in place, some different than others. To measure how concepts and policies of smart urbanism affect the locations of employment centers could establish a general understanding of the what, where and why of suburban economic development. Newly established edge cities show the transformation of what development principles

were in place in 1990 to the elements of transportation infrastructure, housing balance, density, and overall management of "commercial" places. Since much has changed even since 2000, especially in terms of transportation costs and employment in the United States, if this study were to be replicated using 2010 data, the edge cities of Atlanta would likely account for a much larger percentage of the metropolitan employment in addition to appearing more concentrated in terms of both employee and residential densities. At the time of this research, 2010 CTPP data at the TAZ level was not available for the study area, making any analysis of more recent years impossible. A more thorough analysis of the edge cities in the Atlanta metropolitan area could include comparisons of each edge city through the years on an individual basis, this would provide a more detailed explanation of the exact reasons behind one edge city's success or failure over time. For the ideal evaluation to determine the most accurate definition of edge cities, one may need to have a working relationship with not only local planners, but also individuals responsible for the development and management of large office parks and residential developments. Getting specific numbers on actual office space to compare with the edge cities and their boundaries in this study would be very interesting, and could contribute to a long term understanding of suburban employment center development.

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